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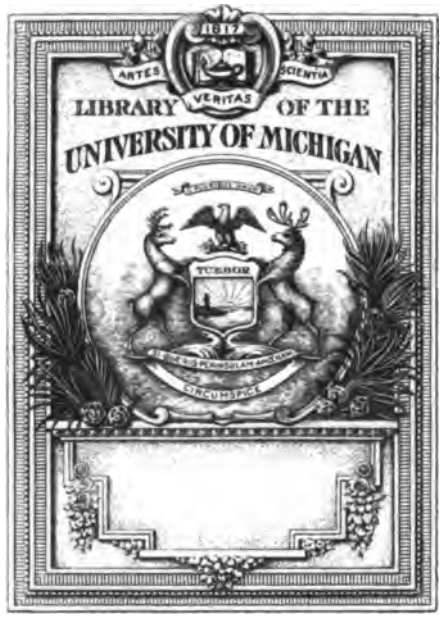
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REPORT

— OF THE —

Superintendent of Water Works

— TO THE —

Board of Water Commissioners

OF

BAY CITY, MICH.

From May 1st to December 31st 1875.

1876.

Chas. C. Gustin, the Cheap Printer, Griswold Block, Bay City, Mich.

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CIVIL ENGINEERS

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BAY CITY, MICH. Water dept

From May 1st to December 31st 1875.

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COMMISSIONERS OF WATER WORKS,

January 1st, 1870.

First Ward,	ANDREW WALTON.
Second Ward,	THOMAS CRANAGE Jr.
Third Ward,	WILLIAM WESTOVER.
Fourth Ward,	WILLIAM SMALLEY.
Fifth Ward,	HENRY M. BRADLEY.
Sixth Ward,	JAMES CLARKE, M. D.
Seventh Ward,	WILLIAM C. McCLURE.

President---WILLIAM WESTOVER.

Superintendent and Secretary,	E. L. DUNBAR.
First Engineer,	A. B. VERITY.
Second Engineer,	F. H. HOLLY.

To the Honorable, The Board of Water Works, of Bay City.

GENTLEMEN: In compliance with the regulations of the Board as amended Oct. 6th., 1875, changing the date for the annual reports from May, 1st., to January, 1st., I submit a report for that portion of the year, (1875.) included between May, 1st, and December, 31st.

INLET FROM SAGINAW BAY.

At the date of my last report, (May 1st.) the Inlet from the Bay was drawing towards completion; that branch of the Works was completed in June, and on the 25th, of that month the water was turned on to the city pipes from that source; since that date the city has been supplied without interruption with the waters of Lake Huron

The length of this pipe from Pumping Wells to the end of the pipe at the Bay, is four miles and sixty-six feet. Fears were entertained by some that the thirty inch pipe as laid, would not afford a supply sufficient to meet all of the demands which might be made in case of a large fire. These fears were never entertained by me, but as Engineers whose opinion I respected had expressed them, I thought it advisable to test the capacity of the pipe as soon as practicable. With this object in view I had all of the Pumps in the Engine House and a four inch Centrifugal Pump outside, run to the full limit of their capacity. With these pumps taking water from the wells at the rate of nearly 8.000.000 gallons in twenty four hours, the water in the wells was lowered but five feet and there remained during the entire time that we were engaged in making the test. This result was entirely satisfactory, showing not only that the pipe was of ample capacity, but it was practically free from obstructions.

The amount paid for Bay Inlet, since May, 1st, is $6,949,42

The entire amount paid for this branch of the Works is $83, 423,23. as follows ;

Paid S. A Van Deusen Contractor for excavation and laying pipe.	$45.837,11
Smith & Wheeler, Contractors for pipe	27.644.36
Thomas Carney, for making special pipe for closing construction,	35.00
John P. Clark, for Dredging channel for pipe in the Bay,	1,612,80
Labor of laying pipe in Bay and expenses of pumping	2.806,98
Masonry at Bay	125.42
Valve and Strainer at Bay including freight and cartage	1,054,19
Excavation, Masonry, Covers for 5 Man holes	1,352,47
Right of way and Land damages including expense of procuring and recording papers	748,81
Local Superintedence,	1.724,25
Labor hauling pipe, Cleaning, Pumping out &c.	245,59
Labor refilling trenches	36.25
Wm O'Connor for extra work on sub contract	200 00
	$83.423.23

RESERVOIR AT SAGINAW BAY.

During the month of May and June, the central portion of the Reservoir at the Bay was dredged to a depth of six feet of water, a portion of the earth removed being thrown on to the north bank of the Reservoir, the balance being removed in scows to deep water in the Bay, outside of the inlet cut. This leaves a Reservoir 175 feet wide by a little more than 300 feet long with twelve feet of water in the outer portion or near the banks and six feet on the central portion. The severe north east storms of the past fall having washed the clay banks to a considerable extent a contract was let in October, to Wm Gordon, for driving piles along the north bank of the Reservoir and along the outside of the banks to Inlet cut from deep water ; 240 feet of this piling has been completed along the north bank of the Reservoir, and the same has been planked up forming a barrier to the seas in that direction.

The labor of driving the piles along the banks of the Inlet cut will be commenced as soon as the ice is sufficiently strong to

work a team thereon, and will probably be completed before spring opens.

Amount paid on account of Reservoir since May, 1st., $2,111.80.

The entire expense of the Reservoir, Inlet Cut. Coffer Dam and Breakwater to date is $16.331.42 as follows;

Paid for Dredging Reservoir,	$3.766.42
Dredging cut to deep water	10.345 05
Coffer Dam, Pipe and Gate for same	1.219 27
Leveling and seeding banks	693.31
Piling and planking for Break water	298 15
Sundry expenses, staking out work &c.	9.22
	$16.331.42

The expense of completing the Breakwater as proposed will be about $1.800.

STREET PIPEAGE.

The length of street mains laid since May 1st., is 19,299 feet of the following sizes;

8 inch Iron. (Branch Castings)	4 1-2 ft,
8 inch Wyckoff,	1,252
6 inch Iron Pipe and Branch Castings,	88 1-2
6 inch Wyckoff,	16,937
4 inch Iron Pipe and Branch Castings	3
4 inch Wyckoff Pipe,	695
3 inch Wyckoff	319

The number of Stop Valves set since May 1st., is 50, of the following sizes;

8 inch,	1
6 inch,	13
4 inch,	36

The number of Fire Hydrants set is 35, all of which are double discharge post Hydrants of the Mathews Patent.

The entire Street Pipeage laid in the city to date is 95,080 feet, or 18 miles and 40 feet, of the following sizes and description of pipe.

16 inch	Iron,	including branches,	1,410 ft.
12	"	"	4,754
10	"	"	84,28 1-2
8	"	"	426 1-2
6	"	"	746
4	"	"	612

Total of Iron pipe,	16,377 feet
10 inch Wyckoff pipe,	6,411 ft.
8 "	11,505
6 "	43,487 1-2
4 "	16,980 1-2
3 "	319
Total of Wyckoff pipe,	78,703 feet.

The entire number of Stop Valves in use in the Street Pipeage is 253 of the following sizes;

16 inch Valves,	1
12 "	4
10 "	10
8 "	24
6 "	65
4 "	149

The entire number of public Fire Hydrants connected with the mains is 127, all of which are double discharge post Hydrants.

The amount paid out since May 1st, 1875, for the distributing mains and their appendages is $15.834.92 as follows;

For Iron pipe, Branch Castings and Cartage,	$6,75
Wyckoff pipe Cash orders,	544,00
Bonds to pipe Co. on contract,	12,000,00
Laying Iron pipe,	41,25
Laying Wyckoff pipe,	3,009,03
Valve acct.	205,39
Hydrant, acct.	28,50
	$15,834,92

And the entire amount paid to date for this branch of the works, after deducting commissions on bonds charged in interest and discount account, is $162,025.22

The fire hydrants are so distributed over the city as to enable the firemen to reach nearly every building, with the exception of those in the vicinity of McEwans Mill, and those east of Sherman Street, between First and Tenth Streets. The buildings are so much scattered over the last described portion of the city, as to render any extensive conflagration impossible, and no one street is built upon sufficiently to warrant the expense of laying a pipe therein for the revenue to be derived from water rates, but in that portion of the city lying east of the Water Works Engine House, in the vicinity

of McEwans Mill, there is a considerable amount of valuable property exposed to the ravages of fire without any protection, save that to be derived from the small hand fire engine kept at the Mill. I therefore recommend to your consideration the laying of a line of six inch Iron pipe from the Engine House east, to a point near the east line of the city, as early in the Spring as practicable. There are a few short lines of pipe in the more thickly settled portion of the city, which it would pay the Board to lay. if it were not for the fact that in most of these cases the pipe would have to be laid for some distance through sparsley settled blocks to connect with another pipe, to enable a circulation of water through the pipe. Many of our citizens who are asking for short lines of pipe are not aware that the water would be useless to them unless the pipes were so connected throughout. If the pipes were run to a dead end the water would soon become stagnant unless a large quantity was used or wasted from it.

PUMPING MACHINERY.

No additions or improvements have been made to the Pumping Machinery since the date of my last report. There has been paid since that time for expenses incured previous thereto, for furnishing grates for the boiler placed in the works last Winter and for some minor expenses of bolts, facing up pipe and fittings for boiler, $99,05.

The pipe which supplies cold water to the condenser is only two inches in diameter and does not supply sufficient water to condense the steam when running the engines for fire service, it therefore becomes necessary to turn the engines on to high pressure every time the fire alarm is given, this makes a consideraple difference with the quantity of fuel consumed. If the size of this pipe was increased to four inches I think it would not be necessary to turn the exhaust from the condenser, as that size pipe would supply sufficent cold water to condense all the steam which could be worked through the piston engines when running at their maximum capacity. I think this change would save in fuel in one season the entire expense which would not be to exceed $75.00.

The reckless use of water during the season from private hydrants in the vicinity of Mills and Salt blocks, and from the public fire hydrants, by persons who paid no attention to the general interest of the city have caused the machinery to be run much faster than would leave a safe margin for fire service in case of a serious fire and had not the city been remarkably

free from fires during the season I fear that we should have had serious difficulties to record. Should the strict enforcement of the amendments to the Water Works ordinance, recently adopted by the city council, check this reckless use of water the capacity of the present Pumping Machinery will be sufficient for years to come. Should it be impossible to controle the use of these hydrants, it will be necessary to add more Pumping Machinery at once, and if this should become necessary I would advise placing in the Works a Piston Engine of sufficient capacity to run the two Rotary Pumps If this is done the Rotary Pumps can be run at the same time as the piston. It is impracticable now to run the Rotary Pumps with the Rotary Engine at the same time that the Piston Engines are running, owing to the large quantity of steam consumed by the Rotary Engine.

REAL ESTATE

The only expense incurred in connection with the improvement of real estate since the date of my last report, has been the construction of a board fence to enclose the plat of ground in front of the Engine House. The expense of this improvement was $47,92. I would recommend that the entire premises at the Engine House be enclosed and graded as soon as the city will grade the street in front and on the east side of the Engine House, and that a board fence be built on the west side of said premises as soon as the weather will permit.

ENGINE HOUSE.

The expenditures for improvements to the Engine House since May 1st, have been, $37,50. All of which was for lumber used three years since for building oil room and coat room, the bill for which was not presented until last December.

BOILER ARCHES.

The amount expended for construction of Boiler Arches since May 1st, is $96,41. All of which was for Bolts, Girders, Doors, Plank &c., for arch built last winter for the new boiler. The bills for which were not presented until July.

IMPLEMENTS ON CONSTRUCTION.

The amount paid for implements for use on construction and property chargeable to Construction Account, is 375,49, of which $279,42 was for the purchase of a four inch Centrifugal Pump and Suction Pipes for the same, used on Bay conduit. and the balance was for small tools ; shovels, picks, axes etc. used on the same work.

INTEREST AND DISCOUNT ACCOUNT.

The expenditures for interest and discount besides the commission allowed on bonds negotiated on contracts, is $2.315,49 of which $2300, was amount allowed to the contingent fund of Bay City, for money paid out of that fund for expenses of negotiating bonds, discounts paid on loans for the relief of the Water Works fund, and for losses sustained by that fund by reason of taking bond in payment of loan. The balance of $15,49 was for interest on money advanced by individuals for laying certain lines of pipe, which moneys were afterwards repaid by the Board.

ENGINEERING AND GENERAL SUPERENTENDENCE.

The amount paid for engineering and general Superintendence since May 1st. is $1,135,00. of which $1000 was the Superintendents salary and the balance was amounts allowed for use of Horse by the Superintendent.

SERVICE TAPS.

The number of Service Taps inserted since May 1st., is 114 of the following sizes:

Three 2 inch Taps connected with Wyckoff pipe.
One 1 inch Tap connected with Iron pipe.
Six 1 inch Taps connected with Wyckoff pipe.
Four 3-4 inch Taps connected with Iron pipe.
Fifty-one 3-4 Taps connected with Wyckoff pipe
Six 1-2 inch Taps connected with Iron pipe.
Forty-three 1-2 inch Taps connected with Wyckoff pipe.

The amount expended for service Taps, account since May 1st, is $365,29, of which $250,14 was for purchase of Taps and $115,15, was for labor inserting Taps and the purchase of screws, manufacturing bands etc. Whole number f service taps inserted to date 459.

OFFICE FURNITURE AND FIXTURES.

The amount paid since May 1st, for office furniture is $15.25 of which $10, was for one of the new maps of the city, by Wm. Mercer, C. E. and the balande for pipe for office stove.

The entire amount paid out during the eight months for Construction Accounts and Furniture and Fixtures being $29,383,54, as follows:

For Bay conduit.	$ 6,949,42
Reservoir at bay,	2,111,80

Distributing Mains, Valves, and Hydrants,	15,834,92
Pumping machinery,	99,05
Real estate, fencing,	47,92
Engine House,	37,50
Boiler arches,	96,41
Implements on construction,	375,49
Interest and Discounts,	2,315,49
Engineering and General Superintendency,	1,135,00
Service taps,	365,29
Office furniture,	15,25

And the entire amount paid out for Construction Accounts since the commencement of the works $351,088,22, of which $152,00 has been in bonds and $199,088,22 in cash orders on the Treasurer.

CURRENT EXPENSES.

The entire amount paid out during the eight months for expenses of operating the works is $5.957 40.

OFFICE EXPENSES.

During the summer of 1874, there was a large amount of work being performed, on construction, which was extended over a large territory, reaching from the Bay to the southern limits of the City. The proper superintendence of this work required my entire time and it was found necessary to employ a clerk, to attend to the collection of water rates, and to assist me in looking after the details of the work. Mr. H. H. Culver was employed in that capacity, and performed his duties faithfully as long as his services were required. It was my duty to reduce expenses as soon as possible and on the first of November last, (the work of construction being practically completed,) I dispensed with the services of Mr. Culver and have since performed all of the labor connected with the assessment and collection of water rates, in addition to my other duties, with the exception of some assistance during a portion of the month of November. The amount paid for office expenses during the eight months has been, $968.80. As follows :

Paid Mr. Culver portion of salary from April 1st, to Oct., 31st.	$415.00
Secretary's salary in addition to salary as Superintendent.	200.00
L. S. Coman, Treasurer, one year's salary	100.00
Wm. Westover, office rent for one year	175.00
H. G. Mercer assistance to Secretary in November	12.00

For stationary, printing, binding, stamps, etc.,	51.75
For lights, fuel, brooms, matches etc.,	15.05
Total	$968.80

REPAIRS, AND CARE OF HYDRANTS, VALVES AND PIPES.

The amount of repairs required on the different lines of pipe have been very slight. No leaks have occurred on the iron pipe and no serious leaks on the Wyckoff pipe. The leaks on the Wyckoff pipe are repaired at the expense of the contractors who furnished it. Prior to Oct., 20, 1875 this work was performed by the contractors; at that time they made an assignment of their property for the benefit of their creditors, since which time I have employed men and purchased material for repairing such leaks as have occurred and have charged the expense thereof to said contractors against the balance due them at the time they made the assignment. The expenses of these repairs are not therefore charged in these accounts, with the exception of a portion of the time of our repairer, who is always detailed to open and close valves for turning the water on and off from the different lines of pipe when repairs are in progress. It will always be necessary to keep one man constantly in the employment of the Board who is well acquainted with the location and construction of valves and hydrants, and has some knowledge of the uses of tools, who can insert the service taps; and remove and dissect valves and hydrants when required. It requires constant care to maintain these appurtenances in good working order, and it is peculiarly necessary in our system of water works that every one of these appurtenances should always be in condition for use. This fact renders it necessary that a competent man should be always at command, and while his labors may be light at times, there is always something to be done about the Works at which he can be employed.

It has been necessary to employ a second man during a portion of the past season. In the early part of the summer it kept one man employed nearly all of the time putting in service taps and in the fall I employed an extra man to assist in preparing the hydrants for winter.

The entire amount expended on account of this branch the works since May 1st, is $461.28.

Of which there has been paid for labor	$388.81
For teaming, horse hire and car fare	17.00

Machine shop, foundry work and material	24.38
Fitting up work shop in basement	31.09

REPAIRS TO ENGINE HOUSE.

The amount expended for repairs to Engine House since May 1st., is $9.80. For new glass for windows and for repairing floor taken up when pipes were put in for compounding steam to the engines.

REPAIRS TO BOILER ARCHES.

The amount expended for repairs to boiler arches since May 1st., is $6.37, for relaying the fire brick in the two arches first built.

REPAIRS TO PUMPING MACHINERY.

The amount expended since May 1st., on repairs to pumping machinery, is $116.16, of which the larger portion was for repairs performed last winter and consisting of

Renewing the feed pipes to boilers	$18.59	
Repairing pony pump	7.70	
New cover for air pump and boring out pump	40.17	
Paint for engines	10.36	76.82
The balance has been for repairs during the season consisting of		
Repairs to valves and gear	$ 5.10	
Leather for pump valves	10.57	
Gauge, tubes, valves, pet-cocks, wire, copper, tin etc.	23 67	39.34
Total		$116.16

IMPLEMENTS FOR REPAIRS.

The amount expended for implemdnts to be used exclusively, or in the main for repairs and operating the works, is $73.62.

Tools for street work	$19.96
Hose, flue-cleaner, oilers, files, etc., for engineer	36 66
Signal gong for Superintendent's house	17.00

FUEL.

I became satisfied soon after the works commenced operations that dry pine slabs, or slabs and edgings were the cheapest fuel we could procure, but every Spring we have been unable to procure sufficient of this class of fuel to supply

us until the new cut was sufficiently dry, last spring was no exception and I was obliged to purchase nearly 200 cords of wood to meet our requirements. That this might not be the case next season, I bargained with James Shearer & Co., for 1800 cords of Slabs of the past seasons cut. Owing to their mill shutting down early in the Fall they piled out only a little more than 1600 cords, but this will I think be sufficient to supply us until July when new slabs will be in good condition These slabs cost us $1.12 1-2 per cord delivered on yard at Engine house. The amount paid out for fuel since May 1st., is, $1709 71 as follows :

Paid Henry Fox for 91 cords of wood	$204.75
John Shabel for 71 1-2 cords of wood	190.12
W. R. Wands for 23 1-4 cords of wood	58.13
H. M. Bradley & Co for 201 1-2 cords of sla	151.13
James Shearer & Co for 858 cords of slabs	643.50
For hauling slabs from Bradley and Shearer	457.91
Balance due on old account to Bridge Co., for tolls	3.90
For bridge tolls and plank road tolls	.27
Total	$1,709.71

OIL, PACKING AND ENGINEER'S SUPPLIES.

The amount paid out for oil, packing and engineer's supplies since May 1st., is $224 66 as follows :

Paid Tousey, Pierson & Beach for lard oil	$ .35
T. Riley Denison for cylinder oil	45.50
For one barrel sperm machine oil from F. H. Penfield including freight and cartage	.45
Kerosene oil, chimneys, wicks etc.,	.73
For rags, emery, brooms etc.,	69.26
Rubber packing, sheet rubber, and empire packing	6 76
Ice for Engine house	12.00
For material delivered before the first of May consisting of lard oil, kerosene and packing	19 61
Total	$224.66

ENGINEER'S AND FIREMEN'S WAGES.

The amount paid since May 1st., for engineer's and firemen's wages, is $2387 00 being the salaries of first and second engineer and two firemen for eight months with the addition of the wages of one man during a portion of the month of July amounting to $27.00, this man being employed

to assist in and about the Engine house while one of the engineers was partially disabled from being caught in the machinery at a time when an extra amount of work required was to be performed.

Total during the eight months from May 1st., to Dec. 31st, 1875 for current expenses.

For office expenses	$ 968.80
Repairs and care of hydrant, valves and pipes	461.28
Repairs to Engine house	9.80
Repairs to boiler arches	6.37
Repairs to pumping machinery	116 16
Implements for repairs	73.62
Fuel	1,709.71
Oil, packing and engineer's supplies	224.66
Engineer's and firemen's wages	2387.00
Total	$5,957.40

And the total amount paid for current or running expenses since the works were commenced $25,031.53.

TREASURY.

The amount withdrawn from the Water Works Fund by requisition on the Recorder, since May 1st., is $38,550.00 as follows :

Bonds		$15,500.00	
Cash		23,050.00	
Balance in Treasurer's hands May 1st.,		1,452.18	40,002 18
Amounts paid out :			
Bonds on construction		12,000 00	
Cash on construction		17,383.54	
Cash for current expenses		5,957.40	35,340.94
Balance in hands of Treasurer December 31st.	Bonds	3,500.00	
	Cash	1,161.24	4,661.24

The amount of cash received at the office from May 1st., to Dec., 31st, is $7,968 82 as follows :

From Water Rates Roll of	1872-1873	$12.65
" "	1873-1874	48,55
" "	1874-1875	566.43
" "	1875, 8 months	6808.19
Total from Water Rates		$7,435.82
From plumber's licenses		$ 7 50
Sales of service taps		379.50

Implement account, sales and commission	13.00
Sale of valves	48.00
Laying Wyckoff pipe	10.00
Rent of boom in front of Engine house	75.00
Total cash collections	$7,968.82

Cash in office May 1st., 1875 $301.40.

Deposited with the city Treasurer to the credit of the Water Works Fund $8,270.22.

Total amount of cash collected at the office from the commencement of the Works to Dec,, 31st., 1875 $23,062.21.

WATER SUPPLY.

Water is now supplied for the following purposes :

199 private dwellings.
68 private families in rooms over stores and offices.
29 private bath tubs.
62 private water closets or urinals
47 private stables.
184 hand hose for sprinkling.
9 public drinking fountains.
28 Hotels,
2 Hotel Barns.
11 Boarding Houses,
3 Public Bath Tubs,
1 Turkish Bath House,
16 Steam Boilers,
51 Private Hydrants and Hose connections for fire protection.
1 Blacksmith Shop,
5 Machine Shops,
4 Foundries,
1 Lock Factory,
1 Cooper Shop,
1 Planing Milll,
1 Slaughter House,
9 Butcher's Shops.
12 Grocery Stores,
2 Dry Good's Stores,
4 Clothing Stores,
2 Book and Stationery Stores,
3 Hardware Stores,
5 Drug Stores,
2 Boot and Shoe Stores

2 Jewelry Stores,
1 Millinery Store,
2 Harness Shops,
3 Small Repair Shops,
3 Bakeries,
1 Laundry,
2 Barber Shops,
7 Livery Stables,
1 Street Car Stable,
1 Dummy Engine,
1 R. R. Co's. Engine House,
2 Passenger Depots,
1 Ware House,
38 Offices
1 Post Office,
1 Express Office,
3 Printing Offices,
4 Banks,
4 Public School Buildings,
2 Churches.
1 Court House,
1 Jail,
2 Photograph Galleries,
1 Brewery,
7 Liquor Stores Wholesale and Retail,
11 Saloons,
4 Restaurants,
3 Billiard Halls,
1 Root Beer Factory,
1 Clothes Cleaning Establishment,
1 Paint Shop,
1 Hose for cleaning Tug boilers
1 Gas Holder,
3 City Stables and Hose Houses,
10 Sleeping Rooms over Stores,
29 Public Water Closets or Urinals,

Total uses 920.

In addition to the uses above enumerated water has been supplied during the larger portion of the past season for

8 Saw Mills using 39 Steam Boilers,
14 Steam boilers in Salt blocks and drill houses
2 Steam boilers in pipe factory.
2 Steam boilers in planing mills.

And for cleaning and filling 3 sets of mill and salt block boilers, not taking their full supply from the works.

The following described premises which have been at some time supplied with water from the Works are now shut off for non-payment of Water Rates or for other causes.

24 Dwelling houses.
4 Hose for sprinkling where water was taken for no other use.
6 Private Stables.
3 Boarding Houses.
4 Stores.
1 Laundry.
2 Blacksmith Shops.
1 Barber Shop.
1 Root Beer Factory.
1 Brewery. (burned.)

Total shut off, 47.

The number of service pipes which supplied the above described premises now shut off is 41.

APPLICATIONS AND PERMITS.

The number of applications for services received at the office from May 1st to Dec. 31st., was 106, making whole number received to Dec. 31st, 505.

The number of permits for service issued during the eight months was 105, making whole number issued to Dec. 31st., 491.

Number of plumber's permits issued during the eight months 128, whole number to Dec. 31st., 526.

WATER PUMPED.

The quantity of water pumped from May 1st., to Dec. 31st, reduced to an average of 40 pounds pressure per square inch at the gauge equivalent to a lift of 104 feet from the surface of the water in the wells was 337,672,531 gallons, by months as follows:

May	41,318,195
June	49,919,000
July	43,255,190
August	43,522,802
September	45,726,967
October	39,930,717
November	43,121,880
December	30,877,780
Total	337,672,531

During this time the Rotary engine and pump have been run 66 1-2 hours pumping 5 203,164 gallons, and the Piston engines and pumps have pumped 332.469,367 gallons.

The pumps have been run 38 hours at Fire Pressure for fire service and water has been taken for the extinguishing of 24 fires. The cost of pumping the 337,672,531 gallons of water has been $4,352,26 as follows:

For fuel consumed.	$1,611,62
Oil, Packing &c. consumed	237,48
Repairs to Pumping Machinery,	116,16
Engineeres and Firemans Wages	2,387,00
	$4.352,26

Making the cost per million gallons pumped, $12,89
And the cost per million gallons raised 1 foot high 12,39-100c
Cost for fuel per million gallons raised 1 foot high 4,59-100c
Cost for fuel per million gallons pumped, 4,77-100c

This is by far the best record for duty which our pumping engines have ever been able to present. And demonstrates that the money expended last winter in putting in pipes for Compounding Steam to the engines was well invested.

The following is a full inventory, showing in detail the quantity of material on hand May 1st. The quantity delivered during the eight months. and the quantity now on hand.

On hand May 1st,		
23 3-4 Cords of wood,	$65,31	
95 Cords of slabs,	133,00	
1 Gallon of Lard Oil,	1,25	
35 Gallons of Cylinder Oil,	43 75	
20 Gallons Sperm Machine Oil,	$15.60	
45 Pounds Tallow,	4 05	
70 Pounds Wiping Rags,	4.90	
7 Pounds Empire Packing,	10.50	
50 Pounds Hemp Packing,	15.00	
14 Pounds Rubber Packing and Sheet Rubber,	11.00	
40 Gallons Kerosene Oil,	6.00	310.36
Delivered from May 1st., to Dec., 31st.,		
185 3-4 Cords of Wood,	$ 453.27	
1059 1-2 Cords of Slabs,	1252.54	
18 Gallons of Lard Oil,	22.35	
45 1-2 Gallons of Cylinder Oil,	45 50	
44 Gallons of Sperm Machine Oil,	23.45	

685 1-2 Pounds of Wipers,	48 64	
Brooms, Emery, Tripoli, etc.,	20.66	
7 1-4 Pounds Rubber Packing, and Sheet Rubber,	5.26	
1 Pound Empire Packing,	1.50	
Red Lead, Copper Wire, etc.,	1 96	
96 1-2 Gallons of Kerosene Oil,	15 92	
Chimneys, Matches, Wicks, etc.,	9.81	
Ice	12.00	1,912 86
Total to be accounted for		$2,223,22
Consumed during the eight months:		
894 1 2 Cords of Slabs,	$1,093.04	
209 1-2 Cords of Wood,	518.58	
18 Gallons of Lard Oil,	22 40	
80 Gallons Cylinder Oil,	88.75	
25 Gallons Sperm Machine Oil,	18.30	
10 Pounds of Tallow,	90	
555 1-2 Pounds of Wipers,	39.54	
3 1-4 Pounds of Rubber Packing and Sheet,	2.16	
6 Pounds Empire Packing,	9,00	
2 1 2 Pounds Hemp Packing,	75	
Brooms, Emery, Tripoli etc.	20.66	
Red Lead, Copper, Wire, etc.,	1.96	
110 1-2 Gallons of Kerosene,	17.63	
Chimneys, Matches, Wicks, etc.,	3.43	
Ice,	12.00	1,849.10
On hand Dec. 31st.,		
260 Cords of Slabs,	292.50	
1 Gallon of Lard Oil,	1.20	
1-2 Gallon of Cylinder Oil.	50	
39 Gallons of Sperm Machine Oil,	20.75	
35 Pounds of Tallow,	3.15	
200 Pounds of Wipers,	14.00	
8 1-2 Pounds Rubber Packing,	6 80	
9 1-2 Pounds Sheet Rubber,	7.30	
2 Pounds Empire Packing,	3.00	
47 1-2 Pounds of Hemp Packing,	14.25	
26 Gallons Kerosene Oil,	4.29	
Chimneys, Matches, etc.,	6.38	$374 12
Total		$2,223.22

The following table shows the quantity of water pumped during each month since May 1st 1873 with the daily average for each month :

		Delivered.	Daily Av,
1873	May,	5,587,280	180,235
	June,	10,274,260	342,475
	July,	16,378,160	528,328
	August,	21,679.840	699,350
	September,	25,055,040	835,168
	October,	27,889,160	899,650
	November,	16,808,480	560 282
	December,	9,112,610	293,955
1874	January,	7,765,452	250,498
	February,	7,728,000	276,000
	March,	11,318,034	365,098
	April,	17,757,620	591,920
	May,	24,000,218	774,200
	June,	29,492,020	983,067
	July,	35,708,012	1,151,871
	August,	35,527,748	1,146,056
	September,	45,032,222	1,501,074
	October,	33,837,513	1,091,532
	November,	28,080,818	949.360
	December,	18,467,141	595,714
1875	January,	15,506,318	500 204
	February,	17,683,057	631,538
	March.	23,412,867	755,253
	April,	22,481,806	749,393
	May,	41.318,195	1,332,845
	June,	49,919,000	1,663,966
	July,	43,255,190	1,395,329
	August,	43 522,802	1,403,961
	September,	45,726,967	1,524,232
	October,	39,930,717	1,288,087
	November,	43,121,880	1,437,396
	December,	30,877,780	996,057

The cost of pumping for each of the periods embraced in my regular semi-annual reports since May 1st., 1873 has been as follows :

From May 1st., to Oct. 31st., 1873

Quantity of water pumped 105,863,640 gallons.

Cost of pumping per million gallons $27.28 cents.

Cost for fuel per million gallons 8.11 1-2 cts.

Cost of raising each million gallons raised one foot high		26 23-100
Cost for fuel for each million gallons raised one foot high,		7 8-10
From Oct., 31st., 1873 to April 30 1874.		
Quantity of water pumped 70,490,196 gallons.		
Cost of pumping each million gallons,	$40 45	
Cost for fuel each million gallons	12.02	
Cost of raising each million gallons one foot high,		38,89-100
Cost of fuel for each million gallons one foot high		11,56-100
From May 1st., 1874 to Oct. 31st., 1874.		
Quantity of water pumped 203,597,733 gallons.		
Cost per million gallons pumped	$17.01	
Cost for fuel per million gallons pumped	6.57	
Cost of raising each million gallons one foot high,		16 36-100
Cost for fuel for raising each million gallons one foot high		6 3-10
From Nov 1st , to April 30th, 1875.		
Quantity of water pumped, 126,032,007 gallons.		
Cost of pumping per million gallons,	$25.88	
Cost for fuel per million gallons pumped	8.96	
Cost of raising each million gallons one foot high		24 8-10
Cost of fuel for raising each million gallons one foot high,		8 6-10
From May 1st, to Dec. 31st., 1875.		
Quantity of water pumped, 337,672,531 gallons.		
Cost of pumping each million gallons,	$12.89	
Cost for fuel per million gallons pumped	4.77	
Cost of raising each million gallons one foot high		12 39-100
Cost of fuel for raising each million gallons one foot high		4 59-100

The entire amount of Bonds voted by the Electors of the city for the Construction of Water Works is as follows:

August 14th. 1871	$118,000.00
August 5th, 1872	59,000.00
August 13th, 1873	150,000.00
September 8th, 1874	50,000.00
Total	$377,000.00

This entire amount has been issued from time to time as required and the following amounts have been negotiated :

Sold by the City Comptroller and proceeds deposited to credit of Water Works Fund,	$211,000.00
Bonds deposited to the credit of Water Works Fund by Comptroller for payment on contracts by the Board	161,500.00
Total	$372,500·00
Leaving balance of Bonds in the hands of the Comptroller not yet negotiated	$4.500.00

The net proceeds of the $211,000 of Bonds negotiated by the Comptroller and by him deposited to the credit of the Water Works Fund was, $201,840.16

Add Bonds deposited to credit of Water Works Fund	161,500.00
Makes total deposits by Comptroller from Bonds	$363,340.16
Proceeds of Loans negotiated by the Comptroller	19,000.00
Collections by Treasurer on assessment of property fronting on lines of pipe	736.07
Cash Collections by the Board from Water Rates. etc ,	23,062.21
Total amount carried to the credit of W. W. Fund	$406,138.44

The Bonds deposited by the Comptroller, to the credit of the Water Works Fund to be used by the Water Works Board in payment on Contracts have been disposed of as follows ;

Paid Wm McEwan, for land on which the Engine House is located.	$ 6.000,00
Drullard and Hays, Buffalo, for Iron pipe	46,500,00
Jas. Flower & Bro's. for Valves	4,000.00
North Western Gas & Water Pipe Company, on Contracts for Wyckoff pipe, Iron Branch Castings, Valves, Hydrants and Trenching,	77,000,00
Holly Manufacturing Company on Contract for Pumping Machinery, Hydrants, etc-	9,000,00
S. A. Van Deusen on Contract for Inlet from Bay and Trenching in city,	8,500,00
Smith & Wheeler.on Contract for pipe for Inlet from Bay,	1,000,00
Total Bonds paid on construction	$152.000,00

Paid Contingent Fund of Bay City on account of Loan,		$ 6,000,00
Balance in hands of Treasurer of the Board to meet payment to the North Western Gas and Water Pipe Company, when it shall become due,		3,500,00
Total Bonds passed through Fund		$161,500,00
The amount of Commissions allowed on the Bonds paid on Contracts is		6,000,00
And the amount of accrued Interest charged on the same is		$4,159,04
Leaving balance against Interest and Discount acc.		$1,840,96

The cash collections made by the Secretary have been from the following sources,

From Water Rates for roll from Jan· 1st to April 30th 1873,	$728,82	
From Water Rates for year, from May 1st, 1873 to April 30th, 1874		5,440.80
From Water Rates for year, from May 1st, 1874 to April 30th, 1875,	6,898,32	
From Water Rates for eight months from May 1st, to Dec 31st, 1875,	6,808,19	
Total from Water Rates		$19,876,15
From Plumbers Licenses,		$ 48,75
Sales of Service Taps and Commissions.		1,642,00
Sales of Tools and Commissions,		25,00
Sales of Building Material,		106,14
Sales of Iron pipe and Branch Castings,		118,15
Sales of Valves,		318,00
Sales of Hydrants,		281,80
Sale of Fuel,		3,50
Sales of Stamps and Stationery,		75
Labor laying Iron Pipe,		37.70
Labor laying Wyckoff Pipe,		11.25
Labor on Service Pipes,		2.00
Rent of Boom		225.00
Dockage on Material for individuals,		29.25
Dicount on Bank Paper,		89
Furnishing and laying Wyckoff Pipe since re-paid by the Board,		335.85
Error on Order No. 521,		05
Total		$23,062.21

The entire amount withdrawn from the city Water Works Fund being drawn by requisition on the City Recorder, signed by the President of the Board is $399,781.04 as follows:

Bonds,	$161,500.00
Cash,	238,281.04
Total	$399,781.04

Leaving a Cash Balance in the hands of the City Treasurer to the credit of the Water Works Fund of $6,357.40.

This Balance together with the Bonds in the hands of the Comptroller, not yet negotiated amounting to $4,500.00 making $10,857,40, less the discount on the Bonds to be negotiated is available for construction accounts.

The items given in the statement of Cash Collection shows that of the $23,062.21 collected but $19,929.13 is properly applicable to the payment of current expenses. The balance of $3,133.08 has been received from construction accounts and should be returned to the fund for construction. This being done the amount paid for current expenses $25,031.53, is $5.102.40 in excess of the amount of cash collections applicable to the payment of such expenses, this amount has been made up from sale of Bonds and Cash Collections on construction accounts and should be replaced as soon as the receipts from Water Rates will warrant it, and before any of the receipts are applied to the payment of interest on Bonds If this is done the amount still available for construction is $15,957.95. The entire amount of orders drawn on the Treasurer of the Board since the Works were commenced is $395,119.80 For the following accounts:

Office expenses	3,570.23
Repairs and care of Hydrants, etc,	1,952.63
Implements on Repairs,	278.35
Repairs to Engine House,	52.35
Repairs to Boiler Arches,	30.22
Repairs to Pumping Machinery,	512.40
Fuel	6,574 90
Oil Packing and Engineer's Supplies,	1,318.70
Engineer's and Firemen's Wages,	10,741.67
Total for Current Expenses,	$25,031.53
For Real Estate,	6,724.83
Dock,	927.56
Tramway to dock,	757,28

Engine House,	8,815.42
Chimney,	2,203.21
Wells,	8,206,93
Store Shed,	185,00
Engine Foundation,	2,088.67
Boiler Foundations and Boiler Arches,	2,535.09
Pumping Machinery,	37,435,10
Iron Pipe and Branch Castings,	51,469.07
Wyckoff Pipe,	63.553,72
Laying Iron Pipe,	14,091.82
Laying Wyckoff Pipe,	16,873.85
Valves,	8,763.19
Hydrants,	7,273 57
Water Meter Account,	1.78
Implements on Construction,	1,721.82
Service Taps,	1.608.52
Traveling Expenses connected with Construction	306.29
Engineering and General Superintendence,	7,856.17
Interest, Discounts and Expenses negotiating Bonds,	2,388.02
Losses on Bonds. negotiated on Contracts being Excess of Commission allowed over accrued Interest charged,	1,840.96
Insurance on Construction Material,	29,00
River Connection,	3,217.99
Bay Connection and Reservoir at Bay,	99,754.65
Furniture and Fixture Account,	410.75
Overpaid Holly Manufacturing Company to be repaid in Pumping Machinery or Hydrants,	48.04
Total for Construction Accounts,	$351.088.22
Error on Order No. 521 (corrected by Cash,)	05
Repaid Loan from Contingent Fund,	19,000.00
Total Orders drawn on Treasurer,	$395,119.80
Amount drawn from Water Works Fund,	399,781.04
Balance in hands of Treasurer, Dec. 31st,	4,661.24

The following Table shows Ledger Balances taken from the Books. December 31st 1875.

Ledger Balances.	Dr.
Real Estate,	$6,424,83
Dock, Tramway and Storing Shed.	1,864.59

Engine House, Chimney and Pumping Wells,	19,149.77
Engine Foundations, Boiler Foundations and Arches,	4,653.98
Pumping Machinery	37,435,10
Inlet from Saginaw River	3.218,99
Inlet from Saginaw Bay and Reservoir	99,754,65
Iron pipe and Branch Castings	51,428,72
Wyckoff Patent Pipe	66,673,97
Laying Iron Pipe	14,031,02
Laying Wyckoff Pipe,	16,847.60
Valves	8,363,19
Hydrants	6,975,57
Interests, Discounts, Commissions and Insurance	4,257,09
Furniture and Fixtures	410,75
Water Meters	1,78
Implements	1,975,17
Engineering and General Superintendence,	7,856,17
Traveling Expenses,	306,29
Office Expenses,	3.569,48
Repairs, and Care of Hydrants, Valves, Pipes	1,950,63
Engineer's and Firemen's Wages	10,741.67
Fuel	7,140,13
Oil, Packing and Engineer's Supplies	1,318,78
Repairs to pumping Machinery.	512,40
Holly Manufacturing Co.,	48,04
Albert Miller	98,75
Dolsen, Walker & Co ,	71,92
A. L. Stewart	15,00
H. Tupper	4.00
Water Works Fund per City Treasurer	6,357,40
L. S. Coman, Treasurer of the Board	4,661.24
Total Dr. Balances	$388,118,67

Ledger Balances	Cr.
City Bond Account	363,340,16
Water Assessment Frontage on Pipe	736.07
Water Rates Roll of 1872 and 1873	728.82
Water Rates Roll of 1873 and 1874	5,440,80

Water Rates Roll of 1874 and 1875	6.898,32
Water Rates Roll of 1875 (May 1st to Dec, 31st,)	6.808,19
Plumber's License	48,75
Service Taps	56.98
Northwestern Gas and Water Pipe Co.,	3,491.85
James Shearer & Co	568,73
Total Cr. Balances	$388,118.67

In addition to the amounts indicated in the above balance sheet as due from individuals, there is due for Water Rates on premises not shut off. as follows :

Thomas Carr ey Jr.,	30,00	
Chapin & Barber	49,65	
Campbell House	21,25	
Dolsen Chapin & Co.,	140,04	
Albert Miller	119,81	
Michael Meagher	4,79	
Thomas Mearnes	1,75	
Wm. Peter	120.13	
Dr. H. Tupper	3,17	
Total		$490,59

There is also due for Water Rates on premises which have been shut offf or non-payment, $56,71

The principal portion of the amount stated as due on premises not shut off is for water supplied during the last quarter and on premises for which the supply has been discontinued by reason of shutting down the Works for the season. In such cases no benefit would be derived from shutting off the supply pipes. Where such is not the case the supply will be discontinued unless the amount due is paid within a very short time.

In compiling this Report I have taken considerable time to examine the records and accounts from the time the Works were commenced and find that a few slight errors have occurred in some of my former reports and monthly statements by reason of payments having been made to different parties on account of contracts for certain material or labor, and the same parties having furnished material for other branches of the Works the quantity of material furnished for the branches of the Works not embraced in the contract, could not be determined definitely until a final account was r n-dered. In such cases it has been customary to report seve al amounts paid contractors during each month as paid

on such a contract, when in fact a portion of the amount would in the end apply on a different branch of the Works. This has been more particularly the case where advances have been made in Bonds. These errors have in no case occurred in the amount of payments, the monthly statements and semi-annual reports being in every instance correct as to full amounts of moneys disbursed, the only correction required being the transfer from one branch of the Works to another.

Respectfully submitted.

E. L. DUNBAR.

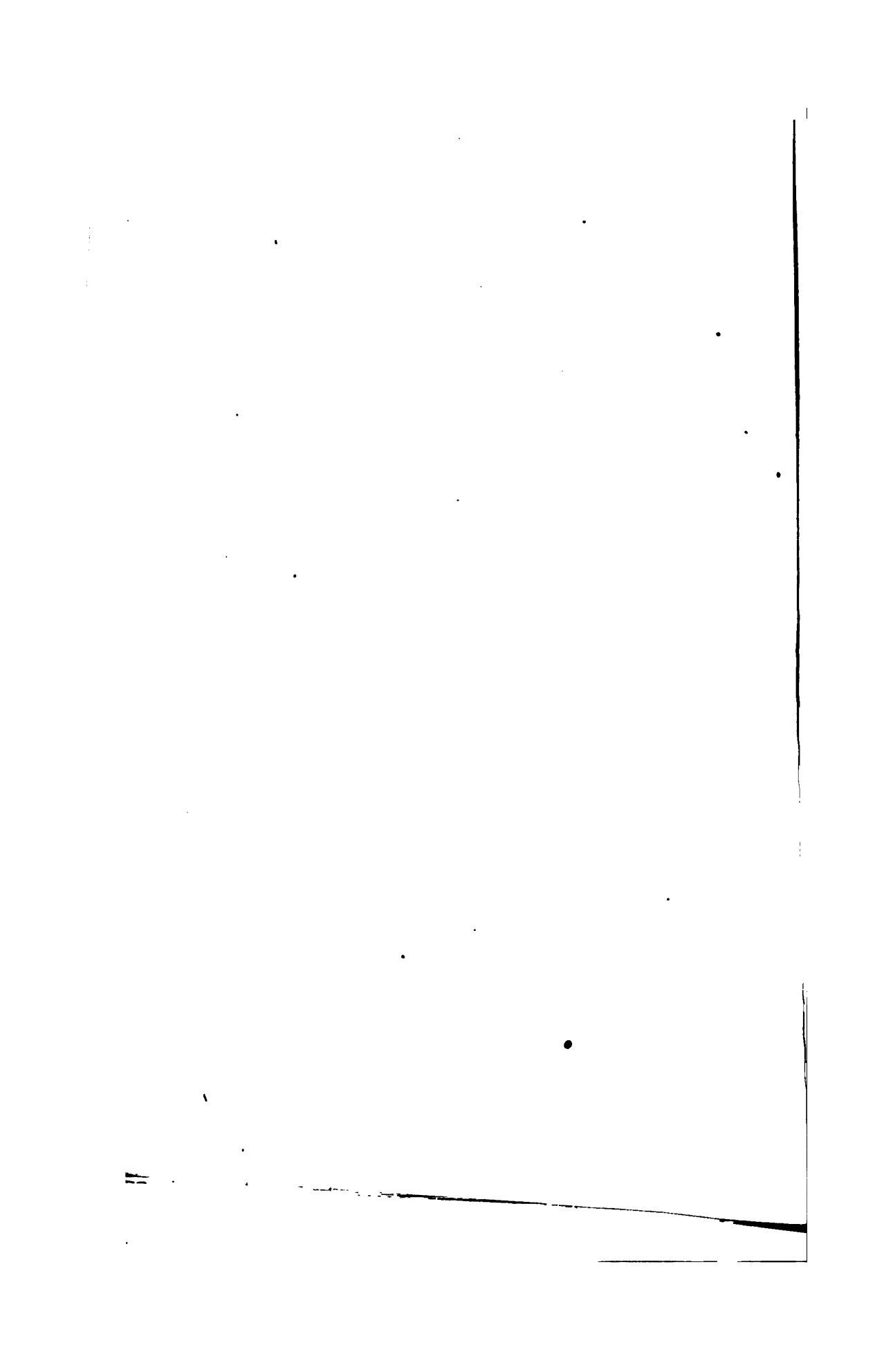
Superintendent and Secretary.

WATER RATES,

And Rules

Governing the Supply of Water.

BAY CITY, MICHIGAN



An Ordinance

Fixing the rates of supplying water to the inhabitants of Bay City, regulating the manner of making connections and using the same, as amended January 3d, 1876.

Sec. 1. It is hereby ordained by the Common Council of Bay City: That all applications for attachment to the distributing pipes, for the purpose of introducing the water into any premises, as well as all applicantions for the use of water, must be made by the party desiring such attachment or use of water to the Board of Water Works at their office, and always with the consent of the owner of the premises into which water is proposed to be introduced, which consent shall be in writing. The applicant must state fully and truly all purposes for which water is required, and frankly, without concealment, answer all questions asked by the Water Works Commissioners' authorized agents, relative to its consumption, and sign on the Board of Water Commissioners books an application setting forth the purposes for which water is desired. Upon complying with these conditions the Secretary of the Board of Water Commissioners will issue a written permit granting the applicant the privilege of a service attachment, and the use of water under the conditions and for the considerations hereinafter stated. At the time of making application the applicant shall deposit with such Secretary a sum of money sufficient to pay for tapping the pipe and for furnishing the connection cock and any other materials the said Board may consider necessary; all work to be performed in tapping the main under such application, shall be done by the employes of said Board.

Sec. 2. All attachments to iron mains for ordinary service shall be by means of brass stops with threads to screw into the main, of one-half, five-eighths, three-quarters, or one inch diameter of water way. Attachments to wood to be made with lead or composite pipe fastened into a wooden plug not to exceed two inches in diameter, or by such other device as may be adopted by said Board. And in order to provide an ample supply with a minimum tax upon the capacity of the works, and at a minimum cost to the consumers, permits for making attachments to supply water for domestic purposes will be issued as follows, to-wit: For supplying dwellings of not more than six rooms one 1-2 inch connectoin; for dwellings of more than six and not more than ten rooms, one 5-8 inch connection; for dwellings of more than ten rooms one 3-4 inch connection; for stores, one connection from 1-2 to 3-4 inches diameter, according to the wants; for laundries, livery stables, stock yards, coffee houses, barber shops, res-

taurants, small manufactories, etc., one connection from 1-2 inch and upwards, as may be required ; for supplying hotels, hospitals, railroad stations and manufactories requiring large quantities of water, the character and size of the attachments shall be determined by the quantity of water required in specified periods of time.

Sec 3. Size of service pipe and stops : All service pipes may be one fourth (1-4) larger in diameter than the connection thro gh which they are supplied, and all stop-cocks in the line of the service pipe, or branches under ground, must be stops with circular water-ways of the same diameter of water way as the pipe in which they are placed, have T heads, and be in every respect equal to the samples in the office of the Board of Water Works.

Sec. 4. Character of pipe and standard weight : In all cases service pipe between the distributing pipe in the street, and the stop-cock, must be lead pipe, or a composition of lead and tin fully equal in strength to the lead pipe hereinafter described, unless such pipe is above two inches inside diameter, in which case cast iron or Wyckoff pipe may be used. All lead pipe so used shall be what is called extra strong pipe, and of the following standard weight :

Lead pipe,	3-8	inch bore.....	2 lbs.	0	oz.	per lineal foot.	
"	1-2	"	2 "	7	"	"	
"	5-8	"	3 "	0	"	"	
"	3-4	"	3 "	10	"	"	
"	1	"	4 "	12	"	"	
"	1 1-4	"	6 "	0	"	"	
"	1 1-2	"	7 "	2	"	"	
"	1 3-4	"	8 "	5	"	"	
"	2	"	9 "	8	"	"	

and cast iron and Wycoff service pipes must be subjected to a hydrostatic pressure of 250 pounds to the square inch before they are laid, or be approved by the Board of Water Works. All pipes and every stop-cock shall be subject to inspection by the Water Works authorized agents, and if found defective in any respect their introduction shall be prohibited.

Sec. 5. Depth of the service pipe : Within the limits of street service pipe shall in no case be laid at a less depth than four feet under the surface of the street, sidewalk or lowest part of the gutter.

Sec. 6. Stop cocks and their location : There shall be a brass stop-cock in each service attachment, under the exclu-

sive control of the Board of Water Works ; the said stop to be placed in the pipe, on the sidewalk, just inside of the line of the curbstone, or outside of the line of the lot, and no person not a direct employe of said board shall open, close or otherwise interfere with said stop-cock. Such stop-cock shall be provided with a box or tube sufficiently large and in ready access for turning on and off water. The top of each box or tube shall be placed on a level with the grade of the sidewalk or alley, and have an iron cover or cap suitably attached, with the word "water" upon the said cover, and in no case shall stop-cocks be placed in vaults under the sidewalk,unless they be so protected or inclosed as to afford no other mode of access except by the removal of the cover from the box on the sidewalk, and in case it becomes necessary to place any stop-cock controlled by said Board deeper than four feet below the surface, the said stop-cock must be provided with a stationary key reaching from the stop to within six inches of the top of the box and terminate with a strong handle similar to that on the stop. Each service pipe must be furnished with a stop and waste below the action of frost so situated that the water can conveniently be shut off and drained from the pipes, to prevent freezing. There shall also be a stop-cock placed in every service attachment located at the first suitable point beyond the street or alley limits, to enable the consumer to turn off the water in case of accidents to the pipe on his premises.

Sec. 7. Hose attachments : Hose attachments connected with service pipe, for sprinkling yards and for washing sidewalks, walks, steps, windows, fronts, etc., shall be placed in the yard wherever convenience and yard room will permit it ; where this is not the case they may be put on the sidewalk inside the curbstone or outside the line of the lot and about one foot distant therefrom. The box containing such hose attachment to be provided with an iron cover suitably attached and placed on a level with the grade.

Sec. 8. Water fixtures on the premises : On the premises supplied with water, the fixtures, such as hydrants,' draws, wash basins, sinks, bath tubs, water-closets, urinals, fountains, hose attachments, tanks, etc., may be such as will best suit the convenience of the consumer, excepting always those which in the opinion of said Board are so constructed as to unnecessarily waste water, the use of which is prohibited.

Sec. 9. Branch service: Applicants desiring to supply more than one house from an attachment, will be permitted so to do, where either a stop or plug of larger diameter, or more than one is provided, so as to equalize the water supply as nearly as possible, but there shall in such case be one principal stop-cock, which shall control the whole supply, and as many auxilliary stops as there are dwellings or premises supplied with water from the attachment all placed outside of the line of the lot in such a manner as to be at all times accessible to the Board or its agents. The failure on the part of any owner or or occupant, to comply with the provisions of this ordinance, or of the rules, regulations and rates adopted by the Common Council of said city, shall cause the water to be shut off by said Board at the stop-cock, and the supply of the party so failing, to be discontinued until a compliance with all laws and rules releating thereto.

Sec. 10. For any extension or alteration in any of the water fixtures of any consumer, written permits from the Secretary of said Board must invariably be obtained before any alteration or extension can be made, and any consumer desiring an extension for the purpose of supplying neighboring premises with water, may receive permission so to do, and in such case he will become responsible for the payment of the water rate for all premises so supplied, so long as the extensions are available for supplying any party with water, and any consumer who shall permit the occupant of neighboring premises to use water from his or their pipe without said neighboring premises, having first been assessed and water rate paid therefor, and the occupant of such neighboring premises, who shall so procure water without payment therefor having previously been made, shall be subject to a fine of not less than five, nor more than twenty dollars, together with the costs of prosecution, and the water rates on such premises for the time they have been supplied.

Sec. 11. Applicants desiring attachments of larger diameter than prescribed, for the purpose of controlling a large quantity of water in a short space of time, and thereby enjoy or possess water privileges not granted to the majority of consumers, will only be granted permits for such attachments on condition that the assessment, after being made according to the regular rates, shall be increased by a per centage equal to one-third the per centage in which the capacity of the extra large attachment exceeds the capacity of the prescribed

attachment. And consumers requiring large supplies of water for manufacturing purposes and who at the same time require, from their extra large attachments, water for ordinary domestic purposes, shall reduce the branches for the latter purpose down to the established size, or else be subject to the payment of an increased water rate as above provided. Provided, that any person opening, or using water from any public fire hydrant, for any purpose except extinguishing fire ; or any person opening or using water from any private hydrant or hose connection, where the opening from said hydrant or hose connection is larger than one and one-half (1 1-2) inches in diameter, or using a hose with nozzle larger than one-half inch in diameter, for any purpose except extinguishing fire,or any person using a hose without a nozzle for any purpose without a written permit from the Secretary of the Board, and under the direct supervision of an employe of the Board, shall be subject to a fine of twenty for the first offense, fifty dollars for the second offense, and one hundred dollars fine, or imprisonment for three months, for each offense after the second, together with the costs of prosecution in each case. And in case any servant, apprentice, minor, or employe shall be guilty of any violation of this section, the master, mistress, employer, parent or guardian of such guilty person shall be responsible for and subject to prosecution for such violation ; provided said violation was done with the knowledge or consent of said employer, parent or guardian.

Sec. 12 Location of hydrants, etc. : Hyrants, hose attachments, goose-necks, faucets or any other device which the consumers may adopt for obtaining water from the service pipes, shall not be located in such a manner as to afford parties occupying neighoring premises, or the public, access to them, unless all parties having access to such devices for drawing water, shall first have their premises assessed, and pay for supplying the same with water.

Sec. 13. Carts for sprinkling streets : Permits for attachments to supply street sprinkling carts may be granted to sprinklers in such number, capacity, and localities as will best accomodate the public. And all persons desiring to sprinkle streets from carts supplied with water from the water works must first obtain a license from said Board for each and every cart used for such purpose, and such person must not use or permit the water from such licensed carts to be used for any other purpose

Sec. 14. No person or persons shall lay any service pipe or do any kind of plumbing work connected with the introduc-

tion and supply of water from the water works unless he or they first obtain written permits from said Board for all separate jobs of plumbing work which he or they may wish to perform. Any plumber wishing to do business in connection with the water works must first give satisfactory evidence to the Board that he is a regularly educated plumber, that he is willing to be governed by the ordinances, rules and regulations which are or may be adopted by the Common Council or said Board; and every plumber shall not only be subject and conform to all and singular the rules, regulations and penalties which now exist, or may hereafter be passed by the Common Council or Board, but he shall also enter into a bond, with one or more sureties, if required by said Board, to indemnity and save harmless of and from all accidents, damages and losses which said city may sustain by reason of his failing to comply with all the rules and regulations as are now or may hereafter be established as aforesaid. And he shall in addition thereto pay a license fee of five dollars per annum to said Board, All licenses issued by said Board shall be made to expire on the first day of Jannary next following the issuing of the same, and in case any plumber shall wilfully violate any of the provisions of this ordinance or the rules adopted by said Board, his license shall be cancelled, Any person other than the plumber mentioned in the permit who shall do any kind of plumbing work in connection with the introduction and supply of water from the water works under cover of a permit granted to a licensed plumber shall be subject to a fine of not less than five dollars and costs of prosecution for each offense.

Sec. 15. Inserting stops and plugs and laying service pipes: In removing pavements, sidewalks, and opening trenches for inserting stops and plugs, laying service pipe, and making repairs or extensions, the material must be removed and replaced in a good and workmanlike manner, depositing the excavating materials in such manner on the street, alleys and sidewalks so as to obstruct them as little as possible and admit of its being replaced in the same position in which it was found, as nearly as practicable, and such work shall be done and completed with all possible despatch. No trench or hole in any street, alley, sidewalk or public place shall on any account be left unguarded. The drilling of distributing pipes, the inserting of connections and manipulating of stop gates shall in all cases be done by persons in the employ of said Board.

Sec. 16. Plumbers' returns: Plumbers shall make full and complete returns to the uses for and to which water is applied under any permit granted. Such returns must be made to said Board by the plumbers doing the work, within forty-eight hours after the completion of said work, as the water will not be turned on any premises until after said return is made, and the work reported to be in accordance with the provisions of this ordinance, and the rules of said Board.

Sec. 17. Location of attachments: Plumbers in making returns of permits shall give the name of the street or alley in which the attachment has been made, and whether the service pipe enters the premises on the north, south, east or west side of the street or alley, and also state accurately the distance of the stop-cock from the near side line of the nearest cross street, lane, alley or other well defined public place, such measurement to be recorded in feet and inches, made in a direction parallel with the said line of the nearest street or alley to where said line intersects the near side line of the nearest cross street, lane or alley. In cases where the alignment of any street, lane or alley is not well defined the measurement must de continued untll a well defined street line is reached which must be intelligently defined in the return.

Sec. 18. No plumber or other person shall make an attachment to any old pipe or water fixtures in premises from which the water has been shut off and the supply discontinued without the party desiring such work to be done having first made application and obtained a re-issue and permit for the same. Nor shall any plumber or other person make any alteration in any pipe or water fixtures attached to the water works distributing pipes to conduct water into adjoining premises, or into stables, baths, water closets, wash basins, cisterns, fountains or for any other purposes whatever without application having first been made, and a written permit obtained from the Board for each and every separate job of such modifications in the water fixtures, and in no case shall any plumber, after the completion and trial of any job of plumbing work, be it the first introduction of service pipe, an extension, or a repair, leave the water on the premises, but shall in all cases close the stop cock and return his permit. And any person who shall cause premises to be supplied with water from the water works, from which the water has been shut off for any violation of the rules and regulations, and any person who shall open any stop cock in the street or alley,

(which has been closed by order of the proper officer of the Board) except on the order of the Superintendent of the Works, shall be subject to a fine of not less than ten dollars, and costs of prosecution for each offense.

Sec. 19. After the plumbing work is finished, returns made, and found to agree with the survey of the Water Inspector, the assessment shall be made according to the established rates, in each case for the period of one year, and payments made in advance for the time intervening between turning on the water and the date of the next quarterly prepayment of water rates. The water rates must in all cases be paid in advance, and by regular consumers for three months in advance, from the first day of January, April, July and October in each year, all payments to be made at the office of the Board between the first and tenth days of January, April, July and October. Provided, however, that the Board may charge and collect water rates for such shorter terms as it may deem advisable from other than regular consumers. Should the uses of water, rated in any assessment, be increased or diminished subsequent to the making of the same, it shall be competent for the Secretary to re-assess the same from the commencement of the next succeeding quarter.

Sec 20. All parties using water from the Water Works for any purpose whatever, will do so at their own risk, as said Bay City will not, nor will said Board in any case be liable or responsible for any damages occasioned by, or growing out of, the stoppage of said water, or an insufficient supply of the same, or for accidents or damages of any kind caused by or growing out of the use or failure of such water. And using, or permitting the water to be used, for any purpose other than that for which application has been made, will be deemed a violation of this ordinance, and subject the offender to the same penalty as provided for the violation of section 10 of this ordinanco.

Sec, 21. Meters: Water consumers can have meters attached to their service pipe whenever they desire it, or the Board may attach meters whenever it deems it proper to do so. When a meter is attached at the request of the consumer, he shall pay the cost of the meter and the expense of attaching it and keeping it in good repair. Said Board shall in all cases have free access to the meters.

Sec. 22. Filling cisterns: Parties having cisterns on their premises may fill them with water from the Water Works, provided that their premises are assessed and they pay for

supplying the same with water, and obtain a written permit from the Board for each and every time the cisterns are to be filled. Where cisterns are so situated as to be accessible to parties occupying neighboring premises, no permit will be granted for filling them with water, unless all premises so situated shall have been assessed, and the owners or occupants thereof pay for the use of the water.

Sec. 23. The use of hand hose is permitted at all hours in the day for the purposes named in the permit, exeept sprinkling yards and gardens, washing sidewalks, walks, steps, windows and fronts; for these purposes the use of the hand hose is restricted to four hours in each day, and no person shall be permitted to use such hose for washing locomotives, cars, coaches or vehicles of any description, or for any purpose in which the momentum of the water from the hose nozzle is alone depended upon for producing the requisite friction to effect washing, unless special permits shall have been granted for such purposes, and extra water rates paid for all such wasteful uses of water. No person shall use a hand hose for sprinkling streets, yards and gardens, washing sidewalks, walks, steps, windows, and fronts, with hose nozzle larger than one-fourth inch in diameter. No person shall use a hand hose for washing streets, gutters, or thawing snow or ice, nor shall they use a hand hose without a nozzle for any purpose whatever. No person shall use leaky hose attachments, broken caps or boxes, nor convert hose into jets for amusement, or suffer the same to run when not in use. No person shall use any hand, or larger, hose for any purpose during a fire, except in the immediate vicinity of the fire and on premises which are in danger of ignition and any person using such hose, except as above provided, between the sounding of the fire alarm and giving the signal for taking off the pressure (knowing that a fire is in progress) will be liable to a fine of not less than five dollars and costs of prosecution for each offense. And any person who shall continue to use such hose during a fire, after being ordered by the Superintendent of the Works to desist, shall be subject to a fine of not less than ten dollars and costs of prosecution, or imprisonment for not less than ten days.

Sec. 24. All consumers or subscribers entitled to the use of water shall keep their own service pipe, stop cocks, key boxes, covers and other apparatus in good repair, and protected from frost, and shall prevent all unnecessary waste of water. No reduction will be made from the assessed rate by

reason of the pipes being frozen up, unless the same shall have been shut off at the stop cock which the Board control. In case the service pipe is found leaking so as to require the water to be shut off to make repairs, and the cap to the key box is missing, or the key box is filled with earth, stones, or rubbish, the consumer or subscriber shall pay for all extra expense attending the shutting off of the water. and have the key box properly repaired before the water shall be again turned on the premises.

Sec. 25. Constant flow of water: Watering troughs in livery stables, stock yards, slaughter houses and other places requiring large quantities of water, will not be permitted to receive a constant flow of water, but only such quantity as will supply their actual wants, unless the consumer has a meter attached to the pipe. And in all cases where a continuous stream of water is required for any purpose, the consumer must have a meter attached as above. In cases where water is discharged into tanks, and the buildings thence supplied, the tanks must be kept perfectly water tight, and the supply pipes to the same provided with ball-cocks, which must always be kept in working order.

Sec. 26. Fountains: Permits for fountains will be issued semi-annually, Each such permit must specify the number of hours, and which out of the twenty-four, per day, the fountain is permitted to play. The supply pipes to all fountains out of doors must be provided with stop-cocks, under the control of the Board. Assessments for out-door fountains shall be made for the length of time the permit is granted, at the expiration of which will be turned off and remain off until another permit is obtained. For in-door fountains, the assessments shall be made for the whole year. Assessments will in all cases, be made for the full capacity of all the jets and sprays, and the quantity of water discharged in a given time shall be calculated at the average pressure, during the hours in which the fountain is permitted to play.

Sec. 27. Boilers: The owners of steam boilers taking a supply of water directly from the service pipe, depending upon the hydrauiic or hydrostatic pressure in the pipe system of the water works for supplying such boiler under working presure, will do so at their own risk, House boilers, for domestic use, must in all cases be provided with vacuum valves, to prevent collapsing when the water is shut off from the distributing pipes.

Sec. 28. In all cases where the orifice in the main pipes

does not exceed the size prescribed in section 2 of this ordinance, the rates shall be as follows, and each additional one-eighth of an inch in the diameter of the orifice will increase the following rates ten per cent:

	Per Annum
For each dwelling house of six rooms or less occupied by one family	$5 00
For each additional room	1 00
For each additional family in one dwelling	3 00
For each private pan water closet or urinal	2 00
For each public pan water closet or urinal	5 00
For each private hopper water closet	3 00
For each public hopper water closet	6 00
For each bathing tub in private family	3 00
For each public bath house with one tub	10 00
For each additional tub	6 00
For each store of 25 feet front or less	6 00
Over 25 feet and less than 50 feet	10 00
For each office of professional persons $2 00 to	5 00
For each family in rooms over stores and offices	5 00
For each barber shop with one chair	4 00
For each additional chair	2 00
For each stable, including water for washing carriages, for one horse	3 00
For each additional horse	2 00
For each church	10 00
For each bakery, per average daily use of flour, for each barrel	3 50
No bakery shall be charged less than	10 00
For each blackshith shop with one forge	3 00
For each additional forge	2 0
Machine shop and foundries, including boiler $50 00 to	100
Street sprinklers, for each cart or team per month	20
For the right to attach a hose of not more than three-fourth of an inch orifice with nozzle not more than one-forth of an inch in diameter, for washing windows or sprinkling gardens in addition to the use for other purposes, and the use of the same limited to four hours each day	6 0
Hotels, boarding houses, shops or manufacturies, steam engines, saloons groceries, provisions and meat stores, breweries, livery stables, cold water engines, and all other places where water is used in large quantities, or where no rate is here fixed at meter rates, to be estimated by the board	
Fountains one sixteenth of an inch opening	6 00
Each additional one-sixteenth of an inch	4 0
Private fire hydrants, with double streams, for the first hydrant	20 00
And for the first single hydrant	15 00
And for each additional hydrant connection for hose	5 00

Meter rates: Where the average daily consumption is 1,000 gallons or less 4 cents per 100 gallons: over 1,000 gallons and under 5,000 gallons, 3 cents per 100 gallons; over 5,000 gallons and under 7,000 gallons, 2 cents per 100 gallons: over 7,000 gallons, 1 1-2 cents per 100 gallons. Provided, that parties using water for steam boilers, for power, or other purposes, may, instead of meter rates, pay for the same at the rate of $4 for each horse power. In estimating the same for either flue or tubular boilers one horse power shall be considered equal to twenty square feet of heating

surface. The above rates to apply except where the boilers are used in connection with saw mill machinery, in which case the rates will be determined by the number of saws, as follows: For each large circular, or for a gang of saws, $9,00 per month: for each muley or upright saw, $3,00 per month. All of the above rates for day service. When the boilers are run during the night, the rate to be 60 per cent of the rate for day service. Provided, further, that boilers so situated as to be readily accessible to the river for a supply of water be allowed a reduction of 30 per cent. from the above rates, and the rates for mill boilers where the same are run during the night for evaporating brine shall include one small drill house boiler not to exceed 15 horse power for pumping brine to supply the salt block in which the brine is evaporated.

Sec. 29. Any person or persons failing or refusing to pay his or their assessment for water rent whenever the same becomes due, or for work and labor done, or materials furnished him by the Board, shall be liable in an action of assumpsit for the amount thereof, to be brought in the name of Bay City. And it shall be the duty of the Board, in addition thereto, whenever the water rates or claim is not promptly paid, to shut off such consumers supply until all such claims, with costs, are fully paid. And the amount, when collected, whether by suit or otherwise, shall be paid to the City Treasurer and by him placed to the credit of the water works fund.

Sec. 30. Any violation of, or failure to comply with any of the provisions of this ordinance, or failure or neglect to comply with any orders or directions of the Board of Water Commissioners, given in accordance with this act shall be punished by a fine of not less than five dollars, and not exceeding one hundred dollars, and costs of prosecution, or imprisonment for any period of time not exceeding three months.

Sec. 31. Any person wilfully interfering with or injuring such water works or pipes, or putting any animal, vegetable or other snbstances in any of the reservoirs, tanks or pipes, or polluting the water therein in any way, shall be punished by a fine not exceeding one hundred dollars and costs of prosecution, or imprisonment for any period of time not exceding sixty days.

Sec. 32. All fines collected under the provisions of this ordinance shall be paid over to the City Treasurer and by him credited to the water works fund.

Adopted January 3d, 1876.

A true copy.) A. STEVENS,
Mayor.

I. G WORDEN,
Recorder.

MISCELLANEOUS RATES ADOPTED BY THE BOARD.

Restaurants	$10 00 to	$25 00	per annum
Saloons	5 00 to	20 00	"
Breweries	25 00 to	75 00	"
Hotels per room (Boilers, Water Closets, Saloons &c., add)		1 50	"
Public Laundries	20 00 to	50 00	"
Dray and Team, horses, each		1 00	"

Chas. C. Gustin the Cheap Printer, Griswold Block, Bay City, Mich.

SIXTH ANNUAL REPORT

OF THE

Superintendent of Water Works,

TO THE

Board of Water Commissioners

OF

BAY CITY, - MICH.

FOR 1877.

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CHAS. C. GUSTIN, PRINTER & BINDER.
1878.

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COMMISSIONERS OF WATER WORKS.

January 1st, 1878.

First Ward,	ANDREW WALTON
Second ward,	THOMAS CRANAGE, Jr
Third Ward,	WILLIAM WESTOVER
Fourth Ward,	WILLIAM SMALLEY
Fifth Ward,	HENRY M. BRADLEY
Sixth Ward,	JAMES CLARKE, M. D
Seventh Ward,	WILLIAM C. McCLURE

President—WILLIAM WESTOVER.

Superintendent and Secretary,	E. L. DUNBAR
First Engineer,	A. B. VERITY
Second Engineer,	F. H. HOLLY

To the Honorable, the Board of Water Works of Bay City.

Gentlemen: In compliance with the Regulations of the Board, I have the honor to submit herewith my sixth annual report, being for the year ending December 31st, 1877.

The year has been marked by no remarkable incidents or accidents connected with the Works, they having performed their required duty at all times with their usual efficiency.

The stringency of the times has prevented the thought of material extension or enlargement of the the works, in any direction, and nothing has been done in that line except to complete the work of protecting the reservoir banks at the bay, which was commenced in 1876. The result of the completion of this work was a marked improvement in the clearness of the water supply, and, notwithstanding the continued high water in the bay, and the severe storms of wind which have prevailed during the Fall months, there has been very little complaint of roily water. The principal source of annoyance to consumers, of late, having been the presence of small fish in the pipes. This evil cannot well be avoided,

entirely, but might be mitigated to a certain extent by extending the pipes to deeper water in the bay.

With a view of ascertaining the probable cost and advantage of extending the inlet pipe farther into the bay, last winter I made a survey and took soundings in the bay in front of the reservoir and inlet cut, and found at the end of the present cut, 3,500 feet from the reservoir, a depth of 7¼ feet of water.

From this point the water deepens gradually, but slowly and very uniformly. At 6,500 feet from the reservoir being 10 feet deep; at 9,000 feet from reservoir, 12 feet; at 13,000 feet from reservoir, 14 feet deep, and at 15,840 feet or 3 miles from reservoir, the water was 15¾ feet deep. I did not think that any advantage would be derived from extending the pipes to a less depth than 10 feet, and as this would require an expenditure of at least $30,000, the present inlet cut being available for laying this pipe 3,500 feet of the distance, I made no suggestion of the plan to the Board, but proceeded with the work of protecting the present works, with a good measure of success.

Notwithstanding the fact that there has been but little, if any improvement in the business and finances of this portion of the country, there has been no falling off in the number of water consumers or amount of water rates collected; on the contrary, there has been a slight increase, both in the number of consumers and amount collected in 1877 over 1876; which, considering the times, I look upon as a favor-

able indication of what the works will do if the former prosperity of the city returns.

The cost of running the works during the year has been less than in 1876.

The quantity of water pumped is about 20,000,000 gallons in excess of 1876, and there has been a consequent increase in the quantity of fuel consumed. This has been more than compensated, however, by the reduction in wages made last summer, and the very few repairs required during the year.

The quantity of water pumped during the year was 538,847,186 gallons against 518,197,129 gallons in 1876, showing an increase of 20,650,057 gallons. The quantity pumped during each month of 1877 was as follows:

January	36,287,138
February	32,682,681
March	37,674,872
April	39,224,541
May	46,836,482
June	41,915,868
July	50,686,711
August	59,076,965
September	50,870,780
October	51,134,902
November	48,525,534
December	43,930,712

Daily average for the year 1,476,294.

Daily average for the month of August 1,905,708.

6,946,183 gallons were pumped under a pressure of 100 lbs. per square inch at the level of the pressure gauge in the engine house, which is equivalent to a lift of 246 feet from the level of the water in the suc-

tion well. 531,901,003 gallons were pumped under the ordinary domestic pressure of 40 lbs. per square inch at the level of the pressure gauge in the engine house, which is equivalent to a lift of 107 feet from the level of the water in the suction well.

The rotary engine has been run 75 hours during the year, pumping 6,465,124 gallons. The piston engines pumping 532,382,062 gallons.

At the time of making my last annual report there were 147½ cords of slabs paid for, on Mr. Rouse's yard, which had not been delivered. During the months of January and February 360$\frac{11}{16}$ cords of slabs were purchased from Mr. Rouse at 85 cts per cord on his yard. During the spring 159 cords were purchased from Mr. McEwan for $1 per cord, delivered at the works. 139¼ cords were purchased of O. A. Ballou & Co., of Kawkawlin, at 50 cts per cord, and an agreement made with John Norgong to haul the same, at 70cts per cord. This last installment fell short 7 cords on measurment on the water works yard, and the shortage was charged to Mr. Norgong on settlement. In June a contract was entered into with Mr. E. F. Rouse for 1500 cords of slabs at 95cts per cord, on his yard, and an agreement entered into with Robert Coyl to deliver the same at 25cts per cord. 1073½ cords of these slabs have been delivered and a verbal contract made with Mr. Rouse to increase the quantity to 1800 cords. During the prevalence of bad roads in November and December it was almost impossible to deliver slabs from Mr. Rouse's, and 54 cords were purchased from Mr. McEwan at 75 cents per cord, and

delivered by Mr. Coyl for 25 cents per cord. The 1419½ cords of slabs purchased from Mr. Rouse in 1876-1877 overrun 47 5-16 cords on measurement on water works yard. As the slabs are purchased by measurement on mill yard and the hauling paid for by measurement on water works yard, there is quite a difference between the quantity purchased and the number of cords hauled and burned. Mr. Rouse has received pay for 31¼ cords on his last contract which have not yet been delivered at the works.

The following is a complete inventory of material (used in running pumping machinery,) on hand at beginning of year, and received during the year:

There was on hand Jan. 1st, 1877:		
100 cords of slabs, costing	$113 00	
3 gallons of lard oil	3 00	
9 " cylinder oil	9 00	
26 " sperm oil	13 75	
34 lbs. rubber packing	27 20	
2 " sheet rubber	80	
4 " hemp packing	1 20	
30 gallons kerosene oil	4 80	
5 lbs. rotten stone	40	
2 1-2 lbs tripoli	20	
5 brooms	1 50	
5 doz. lamp chimneys	5 00	$179 85
There has been delivered at the works during year:		
1974¼ cords of slabs, costing	$2247 51	
15 gallons of lard oil	15 00	
93 gallons of cylinder oil	89 80	
55 lbs. of tallow	4 95	
724 " wipers and waste	53 77	
36¼ lbs. rubber packing and sheet rubber	41 63	
24 " hemp	10 80	
204½ gallons kerosene oil	59 50	
Globes and wicks	75	
Emery	1 08	
Tripoli and lye	5 65	
Red lead and oil	95	
1 doz brooms	2 50	
Ice	12 00	$2,545 89
Total to be accounted for		$2,725 74

The following shows amount of such material used during the year, and amount remaining on hand:

Used during the year:			
2047¼ cords of slabs, costing	$2328	11	
17 gallons of lard oil	17	00	
97 " cylinder oil	94	15	
45 lbs. of tallow	4	05	
19 gallons sperm m. oil	10	05	
724 lbs. wipers and waste	53	77	
55¾ " rubber packing and sheet rubber	56	03	
28 " hemp	12	00	
202½ gallons kerosene oil	55	10	
Globes, wicks and chimneys	1	83	
Tripoli, rotten stone, &c	5	12	
Emery		58	
Red lead and oil		95	
7 brooms	1	92	
Ice	12	00	$2,652 66
On hand Dec. 31st, 1877:			
27 cords of slabs, costing	32	40	
1 gallon of lard oil	1	00	
5 " cylinder oil	4	65	
7 " sperm m. oil	3	70	
10 lbs. tallow		90	
17 " sheet rubber and rubber packing	13	60	
32 gallons kerosene oil	9	20	
44 lamp chimneys	3	67	
Globes, wicks, wicking &c		25	
Tripoli, rotten stone, 12 1-2 lbs	1	13	
Emery		50	
Brooms	2	08	73 08
Total accounted for			$2,725 74

The entire cost of running the pumping engines for the year, has been as follows:

For fuel consumed as above	$2,328	11
" oil, packing, &c., &c	324	55
" repairs to pumping machinery	92	57
" engineer's and firemen's wages	3,480	00
Total	$6,225	23
Making cost per million gallons pumped	11	57
Cost per million gallons raised 100 feet high	10	62
Cost for fuel for million gallons pumped	4	32
" " " " raised 100 feet high	3	97

Taking the whole amount paid for current expenses, including superintendent's salary, office expenses, repairs &c.:

Cost per million gallons pumped is	$16 65
" " " raised 100 feet high	15 30
Cost per thousand gallons pumped a trifle more than	0166

Had the lowest meter rate (one and one-half cents per hundred gallons) been received for all the water pumped, the receipts would have been more than eighty thousand dollars.

The number of fire alarms received at the engine house during the year was fifty-two; and the number of hours the works were run at fire pressure for fire service, forty and one-half.

When I made my last Annual Report, there was a balance in "fund for the repair of Wyckoff pipe," amounting to $1054.40, of which $1000 was in Bay City Water Works Bonds, dated June 15, 1875, with interest coupons from that date attached, the balance ($54 40) being cash. The cash balance has been exhausted, and the Treasurer of the Board has collected the interest coupons on said bonds to June 15, 1877, and placed the amount ($160) to the credit of the Board. This has also been exhausted, and $80 88 in addition thereto drawn against the face of the Bonds. The guarantee on a portion of this pipe has already expired, and the repairs on such portion will hereafter be charged in current expenses. As the guarantee on a portion of this pipe extends over a period of more than two years, and the repairs, to the expiration of that term, are properly chargeable to this fund, I recommend that the $1000 in bonds be sold, and the proceeds used in keeping this pipe

in repair to the expiration of the guarantee, and the balance (if any) left at that time be used in laying new pipe. The number of leaks which have occured in this pipe during the year is 24, of which 13 were shaky or checked pipe or split thimbles, requiring new pieces of pipe; 8 were knot holes stopped by plugging, and 3 were leaks in joints stopped by calking. The entire cost of these repairs, including material used which was in stock at the commencement of the year, was $295.28.

The number of service taps inserted during the year was 50, of the following sizes:

One 2-inch connected with Wyckoff pipe.
Two 1-inch " " " "
Twenty-three ¾-inch " " "
Eighteen ½-inch " " "
Three ¾-inch connected with iron pipe.
One ⅝-inch " " "
" ½-inch " " "
" ⅜-inch " " "

And one ½-inch service tap connected with iron pipe has been taken out.

Making whole number of service taps now connected with the mains, five hundred and seventy-two, of the following sizes:

Seventeen 2-inch connected with the Wyckoff pipe.
Forty-six 1-inch " " " "
One hundred and ninety-seven ¾-inch connected with Wyckoff pipe.
One hundred and ninety-two ½-inch connected with Wyckoff pipe.
Two 2-inch connected with iron pipe.
Five 1¼-inch " " "
Nineteen 1-inch " " "
Twenty-seven ¾-inch " "
Fourteen ⅝-inch " "
Forty-nine ½-inch " "
Four ⅜-inch " "

Six of these taps are connected for the purpose of draining the water from the pipes and have no service attachments, to wit:

One 2-inch connected with Wyckoff pipe.
Two 1-inch " " " "
One ½-inch " " " "
" 1¼-inch connected with iron pipe.
" ½-inch " " "

In addition to the above described service taps there are branch castings connected with the main pipe for supplying private hydrants in mill yards, as follows:

One	6-inch	branch for John McEwan.
"	4-inch	" Dolsen, Chapin & Co.
"	6-inch	" Chapin & Barber.
"	"	" Folsom & Arnold.
"	4-inch	" " "
"	6-inch	" N. W. G. and W. Pipe Works.
"	"	" Pitts & Cranage.
"	4-inch	" " "
"	"	" Gates & Fay.
"	"	" H. M. Bradley & Co.
"	"	" " "
"	"	" Wm. Peter.
"	"	" N. B. Bradley & Co.
"	"	" S. H. Webster.
"	"	" Albert Miller.
"	"	" Smalley Bros. & Co.
"	6-inch	" John McGraw & Co.

The number of separate and distinct services connected with these taps and branches are 581, of which 67 are shut off. The premises shut off are

37 dwellings or boarding houses.	1 drill house.
7 lawn hose.	1 planing mill.
6 stores.	2 stables.
4 vacant lots.	2 small pipes in saw mill
1 machine shop.	1 lock factory.
1 restaurant.	1 blacksmith shop.
1 hotel.	1 oar factory.
	1 gas works.

The premises supplied through the 514 services now open, are:

256 dwellings.
164 lawn & street sprinkling hose.
87 families in blocks.
45 private baths.
80 private water closets and urinals.
50 private stables.
4 bakeries.
1 ball alley.
4 banks.
6 barber shops.
4 bath rooms.
15 boarding houses.
1 brewery.
2 bottling works.
14 butcher shops.
2 blacksmith shops.
2 churches.
1 clothes cleaning.
1 court house.
1 express office.
2 fountains.
2 harness.
1 hose for cleaning tug boilers.
23 hotels.
2 hotel barns.
2 halls.
1 county jail.
1 laundry.
10 livery stables.
3 machine shops & foundries.
6 mill stables.
39 offices.
1 post office.
2 passenger depots.
4 printing offices.
4 photograph rooms.
2 planing mills.
2 paint shops.
58 public water closets or urinals.
28 private fire hydrants.
15 hose connections in mills.
1 R. R. engine house.
7 restaurants.
2 root beer factories.
2 small repair shops.
30 saloons.
5 schools.
1 slaughter house.
7 sleeping rooms in blocks
1 street car stable.
58 stores.
1 warehouse.
1 water motor.
2 telegraph offices.

Also the following, which are assessed by the month for such portion of the time as the water may be used:

Nine saw mills using water for forty-four boilers.
Five salt blocks using water for five boilers.
Fourteen drill houses using water for fifteen boilers.
One pipe works using water for two boilers.

Six saw mills using water for cleaning boilers only.
One pan salt block, cleaning pans.
Two salt blocks using water for slaking lime &c.
One salt block using water for reducing brine.

Also the following (D. H. list), for which no assessment is made.

Three city hose houses and stables.
One city station house and police headquarters.
Two ornamental fountains in public square.
Eleven public drinking fountains, and
One hundred and twenty-eight public fire hydrants put in and kept in repair and working order by the water works employees; but for which no credit is received from the city.

The footings of the regular assessment roll for 1878, are	$8094 50
Estimated amount to be collected from other than regular consumers	2000 00
Total estimated receipts for 1878, from water rates..	$10,094 50

Besides which there remains uncollected:

Roll of 1876	97 73
" " 1877	511 76

Of these amounts about $150 can be collected in a short time.

Total amount of water rates uncollected:

On rolls from 1872 to 1875, inclusive	74 91
" " of 1876	97 73
" " of 1877	511 76
Total	$684 40

Amount collected from water rates, 1872 to 1877, inclusive	$39,122 88

Percentage not collected is one and seven-tenths.
Percentage not collected on rolls of 1872 to 1876, inclusive, is a small fraction more than one half of one per cent.

Cash collections during the year 1877:

From water rates, roll of 1876	$526 33	
" " " " 1877	9213 29	
" " " " 1878	1 25	
" plumber's licenses	22 95	
" sale of scrap iron and leather	40 64	
" labor on repairs to pipes	6 00	
" rent of boom	65 00	
" sale of service taps	170 50	
" sale of valve	33 00	
" sale of iron pipe	5 58	
Total		$10,084 54

These collections have been by months, as follows:

January	$1,208 02
February	346 36
March	434 56
April	1,427 54
May	310 14
June	582 71
July	1,689 39
August	405 38
September	396 40
October	1,764 15
November	463 13
December	1,056 76
Total	$10,084 54

The amount has been deposited with the city treasurer, as per receipts on file, as follows:

January	16, 1877	$500 00
"	25, "	500 00
"	31, "	208 02
February	28, "	346 36
March	27, "	250 00
"	31, "	184 56
April	12, "	605 00
"	28, "	528 48
May	1, "	294 06
June	1, "	310 14
"	30, "	582 71
July	10, "	650 00
"	17, "	550 00
"	28, "	400 00
Augnst	1, "	89 39
"	10, "	250 00
Sept'ber	1, "	155 38
October	1, "	396 40
"	6, "	500 00
"	12, "	500 00
"	17, "	500 00
Nov'ber	1, "	264 15
"	15, "	300 00
Dec'ber	1, "	163 13
"	26, "	400 00
"	31, "	400 00
"	31, "	256 76
		$10,084 54

Total amt. of cash collections during 1877		$10,084 54
Increase over 1876	$105 31	
Cash collections, water rates during 1877		9,740 87
Increase over 1876	$235 49	
Cash collections during 1877, which are applicable to current expenses		9,875 46
Increase over 1876	$271 58	
Current expenses for 1877		8,971 80
Decrease from 1876	$67 46	
Current receipts in excess of current expenses for 1877		903 66
Amount received for service taps in excess of amt. paid out for same,		61 99
Total net gain for 1877		$965 65
Increase over 1876	$294 91	

The above statement does not include interest on bonds, which is provided for by general taxes and paid by the city treasurer, amounting to $30,160 per annum; neither does the water works receive any compensation for the water used by the city fire department for extinguishing fires, and by other deparments of the city government, as shown on the free or D. H. list.

The amount of requisitions drawn on the city recorder during the year was $9,800, as follows:

January	1,	1877,	requisition No. 94	$800 00
"	31,	"	" 95	750 00
Feb'y	28,	"	" 96	750 00
March	31,	"	" 97	700 00
April	30,	"	" 98	800 00
May	31,	"	" 99	800 00
June	30,	"	" 100	1000 00
July	31,	"	" 101	850 00
August	31,	"	" 102	850 00
Sept'ber	29,	"	" 103	800 00
October	31,	"	" 104	800 00
Nov'ber	30,	"	" 105	900 00
				$9,800 00

The city recorder has issued the proper orders on the presentation of this requisition; said orders have been cashed by the city treasurer, and the several amounts placed to the credit of the Board by your treasurer, as shown by the receipts on file.

The disbursements during the year have been as follows:

Office expenses and salary account	$2,233 65	
Repairs and care of hydrants, valves and pipes	551 82	
Engineer's and firemen's wages	3,480 00	
Fuel account	2,152 18	
Oil, packing and engineer's supplies	298 38	
Repairs to pumping machinery	92 57	
" boiler arches	5 30	
" engine house, and insurance	77 00	
" breakwater at bay	55 00	
Implements used on repairs	25 90	
Total amount for current expenses		8,971 80
Repairs to Wyckoff pipe (special fund)	246 43	
Service tap account	108 51	354 94
Wyckoff pipe	7 70	
Furniture and fixtures	6 75	
Inlet from bay	76 38	
Reservoir at bay	789 54	
Total for construction account		880 37
Total disbursements during the year		$10,207 11

The details of these disbursements ase as follows:

For office expenses and salary account.		
Sup't and Secretary's salary, one-half year	$ 900 00	
" " " " "	800 00	
Treasurer's salary, one year	100 00	
Accountant's, examining Secretary's books	153 50	
Office rent, one year	175 00	
Gas for office	7 35	
Coal for office	54 75	
Printing blank notices, assessment rolls &c.	30 00	
Stationery and postage	8 40	
Cleaning and fixing office	4 40	
Collection on draft	25	2,233 65
Amount carried over		$2,233 65

Amount brought over		$2,233 65
For repairs and care of hydrants, valves and pipes.		
Labor on repairs	510 76	
Machine shop and foundry workss	18 18	
Teaming	2 74	
Leather, chain &c	6 21	
Oil, red lead &c	1 93	
Livery	12 00	$551 82
Engineer's and firemen's wages.		
First engineer's salary	1200 00	
Second " "	900 00	
Two firemen, one-half year	720 00	
" " " "	660 00	$3,480 00
For fuel for engine house.		
J. M. Rouse for 360 11-16 cords slabs at 85 cents.	306 57	
John McEwan 159 cords delivered at $1	159 00	
Ballou & Co. and Norgong 132¼ cords delivered at $1 20	158 71	
John McEwan 54 cords at 75 cents	40 50	
E. F. Rouse 1105¼ cords at 95 cents	1050 00	
Hauling 555½ cords at 28 cents	155 54	
Hauling 1127½ cords at 25 cents	281 86	$2,152 18
For oil packing and engineers' supplies.		
93 gallons cylinder oil	89 80	
15 gallons lard oil	15 00	
55 lbs. tallow	4 95	
621 lbs. wipers	43 47	
103 lbs. waste	10 30	
36¾ lbs. rubber packing and sheet rubber	41 63	
24 lbs. hemp packing	10 80	
204½ gallons kerosene oil	59 50	
Lantern globe	25	
Wicking	50	
Emery	1 08	
Tripoli and lye	5 65	
Red lead and oil	95	
Brooms	2 50	
Ice	12 00	$298 88
Repairs to pumping machinery.		
Machine shop and foundry work in 1876	27 43	
Machine shop and foundry work in 1877	10 24	
Leather for pump valves	19 30	
Valves for air pump	12 47	
Extra labor putting in valves	15 50	
Hardware, bolts, gauge glasses &c	7 63	$92 57
Amount carried over		$8,808 60

Amount brought over		$8,808 60
Repairs to boiler arches.		
Brick and clay for relining arch		5 30
Repairs to engine house and insurance.		
Repairing engine house floor	2 00	
Insurance $5,000, three years	75 00	$77 00
Repairs to breakwater at bay		55 00
Implements used on repairs and repairing tools.		
Repairing picks, chisels &c	9 25	
Handles for tools &c	1 30	
Files	2 30	
Socket wrenches for hydrants (2)	7 95	
Sledge	2 10	
Gas plyers	2 00	
Sprinkler	1 00	$25 90
Service taps.		
New taps	64 45	
Screws iron and lead	1 81	
Labor, inserting taps	42 25	$108 51
Repairs to Wyckoff pipe.		
Labor on repairs	153 48	
Teaming	6 00	
Sleeves and new pipes	86 95	$246 43
For Wyckoff pipe.		
Seven feet of 10 inch pipe not used		7 70
Furniture and fixtures.		
Stand light for office		6 75
Inlet from bay		
Labor laying pipe through Reservoir bank	51 62	
Plank for pipe	5 07	
Nails and wire screen	5 73	
Relaying stone work around pipe	61	
Sluice gate in pipe	10 85	
Teaming	2 50	$76 38
For Reservoir at bay.		
Surveys and livery	6 75	
Driving 1192 feet sheet piling	238 40	
" 27 piles (4 furnished)	29 00	
Cutting off and capping 65 piles	20 69	
Spiking plank on breakwater	14 11	
20,727 feet of plank	165 81	
Freighting plank	18 72	
938 feet of inside sheet piling	281 40	
Boom chain	4 83	
Spike	9 83	$789 54
		$10,207 11

The following is a statement of accounts with Water Works fund, and treasurer of the Board, in the aggregate.

The cash balance in Water Works Fund, January 1st, 1877 was	$3342 34	
Amount of cash collections deposited by the Secretary of the Board	10084 54	
Amount withdrawn from Water Works Fund by requisition on the city recorder during the year		9,800 00
Cash balance in Water Works Fund December 31st, 1877		3,626 88
	$13,426 88	$13,426 88
Balance December 31st, exceeds balance January 1st		$284 54

Balance in hands of Treasurer of the Board, January 1st, 1877	$1690 43	
Amt. received by Treasurer from Water Works Fund during the year	9800 00	
Amt. received by Treasurer from interest coupons on bonds in Repair Fund	160 00	
Amount of Water Works orders issued by the Secretary during the year		10,207 11
Balance in hands of Treasurer, Dec. 31st, 1877.		1,443 32
	$11,650 43	$11,650 00
Balance December 31st, less than balance January 1st.		$247 11

Ledger balances, December 31st, 1877.

DEBTOR BALANCES.

Holly Manufacturing Company	47 82
Dolsen, Walker & Co	71 92
A. L. Stewart	15 00
Campbell & Co	4 00
T. Rosa	15 57
Chas. Supe, Treasurer	1443 32
Office expense and salary account	8045 77
Repairs and care of hydrants, valves and pipes	3040 36
Implements on repairs and engineers' tools	368 43
Repairs to engine house and insurance	226 00
Repairs to boiler arches	35 52
Engineer's and firemen's wages	17761 67
Repairs to pumping machinery	764 82
Fuel account	10732 63
Oil, packing and engineer's supplies	1955 85
Amount carried over	$44,528 68

Amount carried over	44528 68	
Repairs to Inlet from bay and reservoir	55 00	
Water Works Fund	3626 88	
Real estate	6284 83	
Dock, tramway and store shed	1853 38	
Engine house, chimney and wells	19097 42	
Engine foundation, boiler foundation and arches	4623 76	
Inlet from Saginaw river	3218 99	
Pumping machinery	37494 29	
Iron pipe and branch castings	52646 83	
Wyckoff patent pipe	66553 04	
Laying iron pipe	14447 54	
Laying Wyckoff pipe	16847 60	
Valves for street mains	8358 79	
Hydrants	6964 00	
Inlet from Saginaw bay	84778 37	
Filter at bay	1683 13	
Reservoir at bay and breakwaters	21514 18	
Implements used on construction	1701 61	
Water meters	1 78	
Interest, discount and commission	4224 17	
Furniture and fixtures	433 50	
Engineering and general superintendence	7856 17	
Traveling expenses, (construction)	306 29	
Insurance, (construction)	29 00	

CREDIT BALANCE.

Fund for repairs to Wyckoff pipe		919 12
Bay City bond account (proceeds of $377,000 bonds)		368045 87
Service taps		216 09
Plumber's license		89 70
Water rates roll of 1872-3		728 82
" " 1873-4		5440 80
" " 1874-5		6908 16
" " 1875, (8 months)		7269 55
" " 1876		9556 26
" " 1877		9217 54
" " 1878		1 25
Water assessment, frontage on pipe		736 07
	$409,129 23	$409,129 23

At my request your honorable body last Spring instituted a careful examination of my account and record books. The result of that examination was satisfactory to all parties; and while the expense was considerable, I do not think the money was misapplied. The work gone over at that time by the accountants embraced five years' accounts, during which the entire work of construction was carried on.

If this examination is now made each year the expense will be small, and it will no doubt be a satisfaction to the public to know that such examination is made; I therefore request that my books for the past year be examined, by one or more competent accountants, for the purpose of verifying my balance sheet, cash account, and other matters embraced in this report, and in the accounts and records of the board.

Respectfully submitted,

E. L. DUNBAR,

Superintendent and Secretary.

Bay City, January 10, 1878.

SEVENTH ANNUAL REPORT

—OF THE—

Superintendent of Water Works,

—TO THE—

Board of Water Commissioners

—OF—

BAY CITY, - MICH.

FOR 1878.

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COMMISSIONERS OF WATER WORKS.

January 1st, 1879.

First Ward	ANDREW WALTON
Second Ward,	THOMAS CRANAGE, Jr
Third Ward,	WILLIAM WESTOVER
Fourth Ward,	WILLIAM SMALLEY
Fifth Ward,	HENRY M. BRADLEY
Sixth Ward,	JAMES CLARKE, M. D
Seventh Ward,	WILLIAM C. McCLURE

President—WILLIAM WESTOVER.

Superintendent and Secretary	E. L. DUNBAR
First Engineer,	A. B. VERITY
Second Engineer,	F. H. HOLLY

To THE HONORABLE, THE BOARD OF WATER COMMISSIONERS OF BAY CITY.

Gentlemen: In compliance with the Regulations of the Board, I have the honor to submit my annual report for the year 1878.

There has been no material extension of the street mains during the year. There has been one new fire hydrant set, on Water street between Shearer and Sherman streets, which necessitated laying one eight inch branch casting and twenty-eight feet of four-inch pipe connecting said hydrant with the pipe already laid. The hydrant on Ninth street at the alley between Water and Saginaw streets, had to be moved by reason of said alley being opened to public travel; this required eleven feet of four inch pipe in addition to that before laid to said hydrant, in order to remove it beyond the limits of the alley.

Total new pipe laid during the year:

3 feet of eight inch iron pipe.

39 feet of four inch iron pipe.

Number of valves set:

One 4-inch valve.

Number of hydrants set:

One double discharge post hydrant.

The street mains now laid in connection with Water Works amount to 18 miles and 1878½ feet of the following sizes:

16	inch	iron	pipe	1,410 feet.
12	"	"	"	4,883 "
10	"	"	"	8,428½ "
8	"	"	"	1,915 "
6	"	"	"	922 "
4	"	"	"	657 "

Total of iron pipe 18,215½ " or 3 miles, 2375½ feet.

10	inch	Wyckoff	pipe	6,411 feet.
8	"	"	"	11,505 "
6	"	"	"	43,847½ "
4	"	"	"	16,980½ "
3	"	"	"	319 "

Total of Wyckoff pipe 78,703 " or 14 miles, 4,783 feet.

The number of public fire hydrants is 129, all of which are double discharge post hydrants of the following description:

90	Holly's	patent	hydrant.
38	Matthew's	"	"
1	Brown's	"	"

The number of stop valves set and in use in the above described lines of pipe is 258 of the following sizes.

16-inch	valves	1.
12	"	"	4.
10	"	"	10.
8	"	"	25.
6	"	"	67.
4	"	"	151.

All but two of these valves are of Flower's patent. One 12-inch valve and one 6-inch valve are Brown's patent.

The expense of keeping these pipes, valves and hydrants in repair during the year was $313.84, which is $474.41 less than was paid in 1877 for repairs on this branch of the Works. Of this amount $259.99 was paid for keeping iron pipe, valves and hydrants in repair, and $53.85 was for repairs to the Wyckoff pipe. There are two reasons for this large reduction on the cost of repairs; one is, the dispensing with the services of one man formerly employed mainly in keeping fire hydrants in order, and in lieu thereof employing labor by the day when required; the other reason is, the few leaks which have occurred, and small amount of repairs required on the Wyckoff pipe.

The five year guarantee of the pipe company has expired on about 5½ miles of this pipe, the repairs to which are now charged in current expenses; the repairs on this 5½ miles of pipe amounted to $18.25; the repairs on the balance of the Wyckoff pipe, amounting to $35.60 is charged against the balance kept back to secure the guarantee, and now known as "The Fund for the Repair of Wyckoff Pipe."

The number of leaks which have occurred in the Wyckoff pipe during the year were 8, of which 4 were from defective joints, which were repaired by caulking, 1 was a small knot hole which was plugged, and 3 were shaky pipe which had to be taken out and replaced with new pipe.

The number of leaks in the iron pipe were 5, all of which were in joints; 4 of these were slight leaks, and were repaired by recaulking the lead; one joint at the end of an 8 inch line blew apart entirely, and the pipe had to be returned to its place and a new joint made.

The pipes have stood the pressure remarkably well, considering the amount and severity of the fire service performed.

The amount paid for office expenses and superintendent's salary during the year was $1,962.31 which is $271.34 less than the amount paid for the same service 1877.

The entire amount disbursed during the year, $8,659.90 of which $8,417.42 was for current expenses. This is $554.38 less than was paid in 1877 for current expenses.

The amount of cash collections made during the year was $10,489.70 which is $405.16 more than the entire amount of cash collections in 1877.

The amount of cash collections from water rates during the year was $10,111.75, an increase of $370.88 from 1877.

The amount received during the year from plumbers' liscenses and from rent of boom was $85.00, and the amount received from sale of service taps in excess of amount paid out for same was $123.22, making total amount of receipts classed as current receipts $10,319.97. The current receipts have exceeded current expenses, $1,902.55, a net gain over 1877 of $998.89.

There is a gradual increase in the number of water takers, the increase being mainly in the line of domestic use. The number of service taps put in during the year was 75, of which 17 were for additional supply to premises before supplied, and 58 were for new services.

One 1-inch tap connected with iron main was taken out, leaving whole number of service taps connected with the mains at the present time, 646.

The service taps inserted during the year have been of the following sizes:

One 1½-inch connected with iron main.
Twelve 1 " " " " "
Six ¾ " " " " "
Four ⅝ " " " " "
One ½ " " " " "
Two 2-inch connected with Wyckoff pipe.
Five 1 " " " " "
Twenty-nine ¾-inch connected with Wyckoff pipe.
Fifteen ½ " " " " "

Of the whole number of service taps now connected with the mains 143 are in iron mains and 503 in Wyckoff pipe.

The quantity of water pumped during the year was 530,197,397 gallons, which is 8,649,789 gallons less than was pumped in 1877; of this quantity, 13,825,311 gallons were pumped for fire service which is just about twice as much as was pumped for the same service in 1877.

There have been 51 fires during the year and the Works have been under fire pressure 94 hours and 20 minutes, against 40 hours and 30 minutes in 1877.

The cost of running the pumping machinery has been $48.37 less than it cost for the same work in 1877. The saving would have been considerably more in this branch of the Works had it not been for the extremely severe fire service performed during the year, and the increased amount of repairs to the machinery in consequence thereof.

It will be seen by the table accompanying this report that the pumping machinery has been run during some months of the year very nearly to its guaranteed capacity of 2,000,000 gallons per 24 hours, and when the large margin required in the city for fire service is considered, the Works have been required to do more than any pumping machinery of its capacity should be called upon to perform. While it has thus far passed through the ordeal successfully, and is now in good order, it is only due to the more than ordinary care and skill exercised by the engineers in charge of that portion of the Works that it has done so, and has been able to meet the demands made upon it for fire service with success.

During the fire which occurred on the 11th of April, at which time the Works were pumping upwards of 1,000,000 gallons per 24 hours for domestic service, 15 fire streams were taken from the Water Works at the fire, some of which were thrown through one and one-fourth inch nozzles, and it is estimated there was equal to 5 more streams playing on endangered property in line of the fire through small hose. To supply this demand upon the Works necessitated running all the

machinery, the piston engines running up to 70 revolutions per minute, and the rotary engine running sometimes as high as 400 revolutions per minute, the pressure being kept for the first 7 hours up to 120 pounds per square inch, when the fire was brought under control sufficiently that it was considered safe to reduce the pressure to 100 pounds, and it was kept at from 90 to 100 pounds for 17 hours more, making just 24 hours that the Works were subjected to heavy pressure without intermission.

Had this fire occurred in the summer season when the mills are taking a large quantity of water, it would have been impossible for the Works to have furnished water for this large number of streams, and there were certainly no more streams on the fire than was necessary to keep it from laying in ashes the main portion of our city.

Owing to the large amount of lumber at all times piled along the river front of the city, we are at any time exposed to a similar fire. It is not safe to restrict the use of water for fire service, if used properly, but it is safe to restrict the use and waste of water for other purposes as now practiced by some consumers, and I believe the time has come when the Board should make every consumer pay for the water he uses or wastes, at a fair price, unless it is for water used in reasonable quantities for sanitary purposes, and I believe that if any discrimination is to be made between consumers, it should be in favor of those who use water for domestic purposes, instead of those who use water for manufacturing

purposes as at present. The argument that the Works have to run anyway, and it does not cost but a little more to run them at 40 revolutions per minute than it does at 25, looks plausible, but it is not sound unless you are receiving enough revenue from the extra 15 revolutions per minute to not only pay the extra cost of running, but to also pay for the extra risk, and wear and tear of machinery, and to replace or enlarge said machinery by the time the extra work destroys its thorough efficiency for fire service. If the city chooses to expend a few thousand dollars more for pumping machinery, instead of requiring those who use and waste large quantities of water to pay a reasonable compensation for the water that passes through their pipes, very well; but one of three things must be done for the Works to maintain their present efficiency; either additional pumping machinery must be put in; the city must stop furnishing water to those who consume and waste water in large quantities, for a mere trifle, or else we must stop having fires which take from 12 to 20 streams to keep them within bounds. My recommendation is that large consumers be required to pay a meter rate about equal to that charged in large cities, say ten cents per thousand gallons, and require them to have meters on their pipes and pay for every gallon that passes through said pipes.

You now have a claim against a mill man for more than $100 for water used during the past summer for a nest of mill boilers where the supply was run for six months from the Water Works *without the knowledge of the proprietor or his employees*, except

the engineer and fireman. Had not the water been taken in a closed tank I should have discovered the fact myself. I have been to the mill several times during the season, but every time I went to the tank the cover was fastened down so that it could not be readily opened, and on inquiring at the office if they were using any water from the Water Works for their mill boilers, the reply was invariably that they were not. Had there been a meter on the pipe this could not have happened without my knowledge soon after it commenced.

The amount of water rates uncollected on the roll of 1878 is $620.80.

The Ordinance requires water rates to be paid quarterly in advance, between the first and tenth days of January, April, July and October, and if rates are not paid promptly when due it becomes the duty of the Board to shut off the supply of water from those premises where the rate remains unpaid.

In all cases where I believed there was a probability of collecting the rate, I have avoided the disagreeable duty of shutting off the supply from delinquents, but consumers soon learn to take advantage of any leniency shown them. I believe that all water takers should be treated alike, and if those in authority allow their water rates to run one or two years without payment why should not others do the same thing. I do not wish to avoid any responsibility, neither do I wish to create ill feeling between the Board and individual members of the city government, but I think *every* person who does not pay his water rate for any one quarter, before the expiration of that quarter should be shut off without

reference to who he is, or what position he holds, and occupants of leased premises should not be allowed to let their rates run beyond the end of the first month unless the owner of the property becomes responsible for its payment.

It is impossible to comply strictly with the Ordinance, and enforce payment of every rate in the first ten days of the quarter without more assistance during that time, neither do I believe it necessary to be as strict in that respect, as the wording of the Ordinance implies, but I think a penalty in the form of percentage should be added to every rate not paid before the expiration of thirty days from the commencement of the quarter, except where water is taken by meter measurment, in which case if the rate is large it should be paid monthly.

I beg leave, to again call the attention of the Board to the advisability of selling the $1,000 in bonds now in the hands of the Treasurer. These bonds are a portion of what was kept back from the North Western Gas and Water Pipe Company, as security for the five years guarantee gived by the Company, on the Wyckoff pipe furnished by them. The title to these bonds became vested in the Board by purchase from the assignee of said pipe company of their claim on said bonds; a portion of the bonds were sold to procure the money to pay this purchase price of said claim, and to pay for the repairs on said pipe. The money so procured has been exhausted, and, in addition thereto $116.48 withdrawn from the City Water Works Fund for other purposes has been used to pay for these repairs. This $1,000 in bonds represents the balance in the

"Fund for the Repair of Wyckoff Pipe," amounting to $883.52 and the $116.48 above mentioned The bonds can now be sold for a premium of about 10 per cent, and there is now one and one-half years interest due on said bonds. If the bonds are not sold at present, I would recommend that the interest coupons be collected, which will replace the amount above mentioned as being taken from other sources, but will leave only $3.52 to pay for repairs on this pipe until another installment of interest is due. The five year guarantee does not expire on the whole of this pipe until September, 1880.

The details of cash collections made during the year have been as follows:

From water rates, roll of 1876	$15 00	
" " " " 1877	315 94	
" " " " 1878	9,780 81	
Total from water rates		$10,111 75
From plumber's liscenses	$20 00	
" rent of boom	65 00	
" sale of service stop boxes	4 95	
" sale of service taps	285 00	
" sale of boards at the bay	3 00	
Total cash collections		$10,489 70

These collections have been made by months, as follows:

January	$1,100 13	
February	527 08	
March	650 60	
April	1,355 00	
May	488 64	
June	640 02	
July	1,613 72	
August	367 22	
September	681 79	
October	1,635 65	
November	293 85	
December	1,136 00	$10,489 70

This amount has been deposited with the city treasurer as collected, as follows:

Jan'y	18,	1878	$500 00	
"	26,	"	450 00	
"	31,	"	150 13	$1,100 13
Feb'y	19,	"	250 00	
"	28,	"	277 08	$527 08
March	26,	"	900 00	
"	30,	"	350 60	$650 60
April,	8,	"	500 00	
"	17,	"	500 00	
"	27,	"	250 00	
"	30,	"	105 00	$1,355 00
May	24,	"	350 00	
"	31,	"	138 64	$488 64
June	29,	"	640 02	$640 02
July	6,	"	600 00	
"	13,	"	500 00	
"	27,	"	400 00	
"	31,	"	113 72	$1,613 72
Aug.	31,	"	367 22	$367 22
Sept.	30,	"	681 79	$681 79
Oct.	16,	"	1,200 00	
"	31,	"	435 65	$1,635 65
Nov.	30,	"	293 85	$293 85
Dec.	31,	"	1,136 00	$1,136 00
				$10,489 70

and by him placed to the credit of the Water Works Fund.

The amount withdrawn from the Water Works Fund by requisition on the recorder during the year has been as follows:

Requisition	No.	106	dated	January	1,	1878	$800 00
"	"	107	"	"	31,	"	$800 00
"	"	108	"	Feb'ary	28,	"	$800 00
"	"	109	"	March	30,	"	$800 00
"	"	110	"	April	30,	"	$700 00
"	"	111	"	May	31,	"	$700 00
"	"	112	"	June	29,	"	$700 00
"	"	113	"	July	31,	"	$700 00
"	"	114	"	August	31,	"	$700 00
"	"	115	"	Sept'er	30.	"	$700 00
"	"	116	"	Oct'ber	31,	"	$700 00
"	"	117	"	Nov'ber	30,	"	$650 00
Total							$8,750 00

The balance in the Water Works Fund, January 1, 1878 was	$3,626 88
Adding cash collections deposited	10,489 70
	$14,116 58

And deducting amount withdrawn by requisition on the recorder.....	$8,750 00
Leaves balance in Water Works fund December 31, 1878.....	$5,366 58

An increase for the year of $1,739 70

The total amount expended by the Board during the year was $8,659 90 for the following accounts:

Office expenses and superintendent's salary.....	$1,962 31	
Repairs and care of hydrants, valves and pipes.	259 99	
Repairs to Wyckoff pipe on which guarantee had expired.....	18 25	
Engineers' and firemens' wages.....	3,330 00	
Fuel for boilers.....	2,172 26	
Oil, packing and engineers' supplies.....	379 94	
Repairs to pumping machinery.....	205 00	
Repairs to boiler arches.....	45 25	
Repairs to engine house.....	25 12	
Implements used on repairs and engineers' tools	19 30	
Total amount for current expenses.....		$8,417 42
Repairs on Wyckoff pipe on which guarantee had not expired.....	$35 60	
Service taps and labor inserting same.....	161 78	
Service stop boxes.....	18 15	
Water meter account.....	95	
Laying iron pipe.....	12 00	
Valve for main.....	14 00	
Total expenditures.....		$8,659 90

The details of these expenditures have been as follows:

For office expenses and superintendent's salary.		
For superintendent's and secretary's salary from Dec. 1, 1877 to May 1, 1878 at $1,600 per annum.....	$666 66	
Superintendent's and secretary's salary from May 1, to Dec. 1, 1878 at $1,500 per annum	875 00	
Assistance in secretary's office from May 1, to December 1, 1878.....	175 00	
Office rent from April 26, 1877 to April 26, 1878	175 00	
Printing superintendent's report for 1877.....	20 00	
Printing 4,600 water notices.....	10 00	
Printing and binding 2,000 receipts.....	10 00	
Accountant examining secretary's books of 1877	16 75	
Gas for office.....	6 60	
Repairs to office furniture.....	5 65	
Time books, ink, carrying up coal, etc.....	1 65	$1,962 31

Repairs and care of hydrants, valves and pipes.		
Labor on general repairs	244 45	
Teaming	2 00	
Two hydrant bases	7 54	
Caps for hydrant nozzles	5 03	
Hardware, nails, etc.	97	
		$259 99
For engineers' and firemens' wages.		
First engineer's salary from Dec. 1, 1877 to Dec. 1, 1878	$1,200 00	
Second engineer's salary, ditto	900 00	
Two firemen at $55 00 per month from Dec. 1, 1877 to March 1, 1878, and $50 00 per month from March 1, to Dec. 1,	$1,230 00	
		$3,330,00
For fuel account		
Paid E. F. Rouse for 694¼ cords slabs under contract of June 1877, at 95 cents per cord	$660 00	
John McEwan for 15 cords slabs at 50 cents	7 50	
" " " 1,000 " " at 70 "	700 00	
" " " 188 " " at 75 "	141 00	
Rouse Bros. for 175 cords of slabs under contract of Nov. 11, 1878 at $1. per cd. deliv'd	175 00	
For hauling 760½ cds. of slabs from E. F. Rouse	198 76	
For hauling 1,203 cords from McEwan's	290 00	
		$2,172 26
For oil, packing and engineers' supplies.		
Paid for 152½ gallons cylinder oil	$145 94	
61½ gallons lard oil	46 24	
31 pounds tallow	2 79	
One barrel hemlock extract	15 88	
201½ gallons kerosene oil	49 53	
826½ pounds wipers	57 85	
9 pounds Heston packing	18 50	
10 " hemp packing	3 00	
33½ pounds square rubber packing	20 10	
11½ " cotton packing	3 80	
Red lead and oil for same	1 66	
Oxalic acid, concentrated lye and tripoli	5 50	
Tacks, wire, solder, asphalt and putty	2 07	
Matches, lantern globes, wicks and wicking	4 68	
Ice for engine house	7 40	
		$379 94
For repairs to pumping machinery.		
For repairing boilers	$44 85	
New grates	30 08	
Gas pipe and fittings for feed pipes	8 14	
Valves for feed pipes	9 35	
Repairing feed pumps	8 08	
Braces, steel plate for valve seat and bolts for left back pump	24 60	

Teaming, drilling and bolts for valve on right back pump	20 20	
Balance on new valve paid Holly man'fg com'y	4 42	
Freight on valves and cans, and telegraphing	2 78	
Sheet copper	2 20	
Babbit metal	6 72	
Valves for air pump	7 88	
Leather for pump valves	11 36	
Extra labor at engine house putting in valves	11 25	
Blank flange, bolts, lead, etc. for valve	6 09	
Covers for piston rods	7 00	
		$205 00
For repairs to boiler arches.		
For fire brick and fire clay	$12 40	
Stone and mortar	9 00	
Teaming	35	
Labor	23 50	
		$45 25
For repairs to engine house.		
For lumber for repairing floor	$19 82	
Labor	4 00	
Nails and hinges for door	1 30	
		$25 12
For implements on repairs and engineers tools.		
For files and handles	$3 15	
Two open end wrenches	5 25	
Copper hammer	2 80	
Oilers	88	
Oil brush	50	
Steel drift	1 31	
Tape line	4 50	
Repairing tools	91	
		$19 30
For repairs to Wyckoff pipe on which guarantee had expired.		
For labor	$17 50	
Plugs	75	
		$18 25
For repairs to Wyckoff pipe on which guarantee had not expired.		
For labor	$19 40	
Teaming	2 50	
One 6-inch sleeve	7 50	
One 4-inch sleeve	5 00	
Four feet of four inch pipe	1 20	
		$35 60

For service taps account.		
Paid for one doxen 1-inch taps lor Wyckoff pipe	$28 80	
Two dozen ¾-inch taps for Wyckoff pipe.....	39 60	
One " 1 " " " iron pipe.....	20 20	
Freight and cartage on taps.....	1 25	
Labor putting in taps.....	59 75	
Making bands.....	3 00	
Band iron.....	83	
Red lead and screws.....	2 13	
Pipe and connections for D. & B. C. R. R. Co...	6 22	$161 78
For service stop boxes.		
For one dozen iron extension stop boxes.....	$18 00	
Cartage.....	15	$18 15
For water meter account.		
For freight on 3 meters from Union Water Meter Company.....		95
For valves.		
For one 4-inch Flower valve in hydrant pipe...		$14 00
For laying iron pipe.		
For labor.....		$12 00

In addition to the amount paid out for repairs to pumping machinery, as above, there has been credited to the Holly Manufacturing Co., $47 82, old balance due from that company for amount before overpaid. This credit is for one set of new cams for cut-offs, $16 00, and for remainder of purchase of new valve for right back pump, $31 82, the total cost of this valve being $36 24.

When I made my last annual report, Mr. E. F. Rouse had been paid on his contract of June, 1877, for 31¾ cords of slabs more than had been delivered at that time. By referring to the amount paid Mr. Rouse on that contract during the year and the number of cords of slabs delivered from there, it will be seen that the 1800 cords furnished under that contract, over-run 33¾ cords when measured on Water Works yard which last measurement, was the one on which payment was made for the hauling.

The quantity of water pumped during the year, was 530,197,397 gallons, of which 516,372,086 gallons were pumped against the ordinary domestic pressure of 40 pounds per square inch at the pressure gauge, which is equivalent to a lift of 107 feet from the surface of the water in the wells.

13,825, 311 gallons were pumped against an average fire pressure of 100 pounds per square inch at the guage, which is equivalent to a lift of 246 feet from the surface of the water in the wells.

The following statements show the actual cost of this pumping and the duty performed by the pumping engines:

Inventory of material used at engine house.

On hand January 1, 1878.			
27 cords of slabs,	costing.....	$32 40	
1 gallon of lard oil	"	1 00	
5 " " cylinder oil	"	4 65	
7 " " S. machine oil	"	3 70	
10 pounds of tallow	"	90	
17 " sheet rubber & packi'g	"	13 60	
32 gallons kerosene oil	"	9 20	
44 lamp chimneys	"	3 67	
Globes, wicks, etc.	"	25	
Tripoli and rottenstone	"	1 13	
Emery	"	50	
Brooms	"	2 08	
Total on hand January 1, 1878.....			$73 08
Delivered at the Works during the year.			
2,138½ cords of slabs	costing.....		$2,202 42
61½ gallons of lard oil	"		46 24
152½ gallons of cylinder oil	"		145 94
31 pounds tallow	"		2 79
826½ pounds wipers	"		57 85
9 pounds Heston packing	"	13 50	
10 " hemp "	"	3 00	
33½ " sq. rubber "	"	20 10	
11½ " cotton "	"	3 80	$40 40
10 " red lead	"	1 26	
½ gallon boiled oil	"	40	
201½ gallons kerosene oil	"	49 53	
9 lantern globes	"	1 60	
Lamp wicks and wicking	"	88	
Matches	"	2 20	

Oxalic acid and concen'ed lye	"	3 50	
Tripoli	"	2 00	
Copper tacks, wire, etc.	"	2 07	
Ice for summer season	"	7 40	
1 barrel hemlock extract	"	15 88	
Total deliver'd during the year			$2,582 36
Total to be accounted for			$2,655 41

Used during the year.

2,134¼ cords of slabs	costing	$2,203 82	
59½ gallons lard oil	"	45 29	
132½ " cylinder oil	"	126 09	
7 " S. machine oil	"	3 70	
41 pounds tallow	"	3 69	
58 " packing	"	37 50	
786½ " wipers	"	55 05	
Red lead and oil	"	1 66	
208½ gallons kerosene oil	"	52 86	
14 lamp chimneys	"	1 17	
Globes, wicks, etc.	"	4 10	
Oxalic acid and concen'ed lye	"	2 33	
Tripoli and rottenstone	"	2 63	
Tacks, wire, etc,	"	2 57	
Hemlock extract	"	9 88	
Brooms	"	1 90	
Ice	"	7 40	
			$2,561 64

On hand December 31, 1878.

31 cords of slabs (paid for)	costing	$31 00	
3 gallons lard oil	"	1 95	
25 gallons cylinder oil	"	24 50	
23 lbs. pack'g and sheet rubber	"	16 50	
40 " wipers	"	2 80	
25 gallons kerosene oil	"	5 87	
30 lamp chimneys	"	2 50	
Globes, wicks and wicking	"	83	
Oxalic acid and lye	"	1 17	
Tripoli and rottenstone	"	50	
Hemlock extract	"	6 00	
Broom	"	18	
Total on hand			$93 80
Total accounted for			$2,655 44

Entire cost of running pumping machinery for year.

For fuel consumed as above	$2,203 82	
Other material used as above	357 82	
Repairs to pumping machinery	252 82	
Engineers' and firemen's wages	3,330 00	$6,144 46

Cost per million gallons pumped	$11 59
" " " " raised 100 feet	10 48
Cost of fuel per million gallons pumped	4 16
" " " " " " raised 100 feet	3 76

Taking the entire amount paid for current expenses, including superintendent's salary, office expenses, repair to pipes, etc.

The cost per million gallons pumped is.....$15 87
" " " " " raised 100 feet..... 14 35

The following table shows the quantity of water pumped during each month of the year with the piston engines, also with the rotaries, and the number of hours run for fire, and the number of hours the rotary engine and pump were run:

Month.	No gallons pump'd by piston engines and pumps at 40 pounds pressure.	No gallons pump'd by rotary engines and pumps at 40 pounds pressure.	No gallons pump'd at fire pres're 80 to 120 pounds.	Total No. gallons pumped.	Hours run at fire pressure.	Hours run by rotaries
Jan.	39,094,031	789,019	1,799,000	41,682,050	15	10
Feb.	33,063,400	120,000	102,121	33,285,521	1	2
Mar.	32,863,493	814,782	450,490	34,128,765	5	17
Apr.	34,456,666	880,910	5,480,910	40,818,486	28	13
May.	43,259,910	267,000	———	43,526,910	—	4
Jun.	52,521,499	80,591	1,980,790	54,582,880	13	1
July.	54,663,990	488,000	86,000	55,237,990	1	7
Aug.	52,424,491	80,000	41,000	52,545,491	½	1
Sep.	44,842,906	540,920	600,000	45,983,826	5	6
Oct.	43,082,934	320,000	2,200,000	45,602,934	16	4
Nov.	39,142,577	380,000	385,000	39,907,577	4	4
Dec.	41,938,143	256,824	700,000	42,894,967	6	6
Total	511,354,040	5,018,046	13,825,311	530,197,397	94½	75

The regular assessment roll for 1879 amounts to..... $8,523. 50
Estimated amount to be collected from mills, building purposes, and other than regular consumers..... 2,000 00
Total estimated receipts from water rates roll of 1879.. 10,523 50
Besides which there is uncollected:
On roll of 1877..... 204 97
On roll of 1878..... 620 80

About $500 00 of this will probably be collected during the year, the balance is due from premises which have been shut off, and while a portion of it may be collected, the larger part of it probably will not.

The following table shows amount collected, amount uncollected, and the total amount of roll for each year since the Works commenced operation:

Years' assessment.	Amount Collected	Amount uncollec'd	Total of Roll.	Per ct. uncoll.
1873. Jan. 1 to Apr. 30.	$728 82	$ 00	$728 82	—
1873-4. May 1 to Apr. 30.	5,440 80	1 60	5,442 40	—
1874-5. May 1 to Apr. 30.	6,908 16	44 85	6,953 01	00.64
1875. May 1 to Dec. 31.	7,269 55	28 46	7,298 01	00.39
1876.	9,571 26	82 73	9,653 99	00.85
1877.	9,533 48	204 97	9,738 45	02.10
1878.	9,782 06	620 80	10,402 86	05.96
Totals - -	49,234 13	983 41	50,217 54	01.96

The assessment roll for 1879 is for the following uses of water:

298 dwelling houses.
170 lawn and street sprinkling hose.
83 private families in blocks.
59 private bath tubs.
101 private water closets and urinals
45 private stables.
4 bakeries.
3 banks.
5 barber shops.
2 public bath houses.
3 blacksmith shops.
15 boarding houses.
2 bottling works.
1 brewery.
15 butcher shops.
1 church.
1 court house.
1 express office.
1 flouring mill.
1 gas works.
3 harness shops.
3 halls or lodge rooms.
1 hose for cleaning tug boilers.
24 hotels.
2 hotel barns.
1 jail.
1 library building.
10 livery stables.
3 machine shops and founderies.
6 mill stables.
42 offices.
1 post office.
4 paint shops.
2 passenger depots.
3 photograph rooms.
2 planing mills.
4 printing offices.
28 private fire hydrants.
19 private hose for fire protection.
69 public water closets and urinals.
1 R. R. engine house.
2 small repair shops.
9 restaurants.
2 root beer factories.
54 saloons and bars.
5 school buildings.
1 slaughter house.
1 street car stable.
57 stores.
2 sale stables.
1 telegraph office.
1 water motor.

Besides the following described premises not running at present, have water pipes connected and use water from the works for a portion of the year.

8 saw mills.	1 pipe works.
5 salt blocks.	1 box factory.
14 drill houses.	4 fountains.

5 saw mills using water for cleaning boilers only.
1 pan salt block using water for cleaning pans.
2 salt blocks using water for slaking lime.

Water is supplied for the following uses for which no assessment is made:

3 city hose houses and stables.
1 city building occupied by station house and city offices.
10 public drinking fountains.
2 ornamental fountains in public square during summer season.
129 public fire hydrants kept in repair and working order at the expense of the Water Works.

The supply is shut off from 73 services as follows:

12 services where buildings have been burned.
6 services where plumbing is not completed.

1 saw mill.	1 machine shop.
2 private hydrants.	1 cooper shop.
1 boiler shop.	1 blacksmith shop.
1 lock factory.	2 private stables.
1 church.	6 stores.
1 boarding house.	27 dwellings.
1 hotel.	13 hose for sprinkling.

2 pasture lots.

The following premises, not assessed are supplied with pipes which are not shut off, by reason of neighboring premises which are occupied, using water from the same pipe, or for other reasons as stated:

Beckwith block. (Burned and being rebuilt.)
Lamont's planing mill. " " " "
4 pipes in blocks shut off inside premises.
1 fish market " " " "

11 vacant stores.	3 dwellings.
6 vacant dwellings.	2 vacant basements.
3 barber shops.	2 vacant stables.
1 vaca't blacksmith shop	1 vacant saloon building.

The following balance sheet shows the ledger balances from the commencment of the Works to the first day of January 1879. Heretofore in crediting amounts received for rent of boom, dockage on material, etc., I have credited the amount to real estate, dock, etc. In making out this balance sheet, I have opened an account with rents, dockage, etc., and have credited the entire amount received from rent of boom, dockage, etc., to this account, charging them back to the several accounts to which they were before credited, this makes the balance sheet show the actual cost of each portion of the works.

The sum of the debtor balance on construction accounts amounts to $361,389 74, while the amount credited to bond account being the proceeds of $377,000 of bonds voted by the people for the construction of Water Works is $368,045 87 leaving a balance of $6,656 13 yet to be used on construction as soon as the collections have increased the balance in the Water Works fund to such an amount as to warrant this expenditure.

Balance sheet of Bay City Water Works, January 1, 1879.

LEDGER BALANCES, DR.	
Real estate	$6,724 83
Dock, tramway and store shed	1.882 63
Engine house, chimney and wells	19,097 42
Engine foundation, boiler foundation, & arches	4,623 76
Inlet from Saginaw river	3,218 99
Inlet from Saginaw bay	84,778 37
Filter at bay	1,683 13
Reservoir and breakwater at bay	21,491 78
Pumping machinery	37,494 29

Iron pipe and branch castings	52,646 83		
Wyckoff patent pipe	66,553 04		
Laying iron pipe	14,459 54		
Laying Wyckoff pipe	16,847 60		
Valves for street mains	8,372 79		
Public fire hydrants	6,964 00		
Implements on construction	1,701 61		
Furniture and fixtures	433 50		
Engineering and general superintendance on construction	7,856 17		
Travelling expenses on construction	306 29		
Interest, discounts and commissions on const'n	4,224 17		
Insurance on construction material	29 00		
		$361,389 74	
Water meters	2 73		
Service stop boxes	13 20	15 93	
Office expenses and salary account	10,008 08		
Repairs and care of hydrants, valves and pipes	3,318 60		
Repairs to engine house and insurance on same	251 12		
Repairs to boiler arches	80 77		
Repairs to pumping machinery	1,017 64		
Engineers' and firemens' wages	21,091 67		
Oil, packing and engineers' supplies	2,335 79		
Fuel account	12,904 89		
Implements on repairs and engineers' tools	387 73		
Repairs to reservoir and breakwater	55 00		
		$51,451 29	
Water Works fund per city treasurer	5,366 58		
Orrin Bump, treasurer of Board	1,533 42	$6,900 00	
Dolsen, Walker & Co	71 92		
A. L. Stewart	15 00		
Campbell & Church	4 00		
Thomas Rosa	15 57		
Rorison & McKinney	19 40		
Detroit & Bay City R. R. Co	13 50	$139 39	
Total Dr. balances		$419,896 35	

LEDGER BALANCES.	Cr.	
Bay City bond account. ($377,000 bonds.)	368,045 87	
Water assessment frontage on pipe	736 07	
Water rates roll of 1873, Jan. 1, to Apr. 30	728 82	
Water rates roll of 1873-4, May 1 to Apr. 30	5,440 80	
Water rates roll of 1874-5, May 1, to Apr. 30	6,908 16	
Water rates roll of 1875, May 1 to Dec. 31	7,269 55	
Water rates roll of 1876	9,571 26	
Water rates roll of 1877	9,533 48	
Water rates roll of 1878	9,782 06	
Rents, dockage, etc	534 25	
Plumbers' liscenses	109 70	
Service taps	352 81	
Fund for repair of Wyckoff pipe	883 52	
Total Cr. balance		$419,896 35

The books of this office were thoroughly examined at the close of 1877 by Mr. Geo. W. Beadle, Jr. whose report is on file certifying to the correctness of the accounts at that time. I would like to have this examination made every year, and beg leave to suggest to the Board the propriety of inviting the Common Council to appoint a committee to join in the examination.

Respectfully submitted,

E. L. DUNBAR,

Superintendent and Secretary.

Bay City, January 13, 1879.

EIGHTH ANNUAL REPORT

OF THE

SUPERINTENDENT

OF

Water Works,

To the Board of Water Commissioners

OF

BAY CITY, MICH.,

FOR 1879.

BAY CITY, MICH.:
JAS. GRAY, PRINTER, OBSERVER OFFICE.
1880.

EIGHTH ANNUAL REPORT

OF THE

Superintendent of Water Works

TO THE

Board of Water Commissioners

OF

BAY CITY, MICH.,

FOR 1879.

BAY CITY, MICH.:
JAS GRAY, PRINTER, OBSERVER OFFICE.
1880.

Commissioners of Water Works.

JANUARY 1ST, 1880.

First Ward,	ANDREW WALTON.
Second Ward,	THOMAS CRANAGE, JR.
Third Ward,	WILLIAM WESTOVER.
Fourth Ward,	WILLIAM SMALLEY.
Fifth Ward,	HENRY M. BRADLEY.
Sixth Ward,	WILLIAM DAGLISH.
Seventh Ward,	GEORGE C. MEYERS.

OFFICERS.

President,	WILLIAM WESTOVER.
Superintendent and Secretary,	E. L. DUNBAR.
First Engineer,	A. B. VERITY.
Second Engineer,	F. H. HOLLY.

To the Honorable Board of Water Works of Bay City, Michigan :

GENTLEMEN—I have the honor to submit herewith my Annual Report, for the year ending December 31st, 1979.

The marked improvement in business during the year has caused an increased demand for a supply of water. To meet this demand it has been found necessary to increase the pumping capacity of the Works, and to lay some additional distributing pipe.

PUMPING MACHINERY.

In July last the quantity of water pumped for domestic service alone reached 74,000,000 gallons. Taking into consideration the large margin required in this City for fire protection, and the fact that the pumping engines were only intended to supply 2,000,000 gallons per day, it became absolutely necessary that something be done to increase the capacity of the pumping machinery. Another set of piston engines and pumps were what the Works required and what I should have recommended to the Board, had the funds of the City been in a condition to warrant the expenditure which such an improvement would require. This being out of the question, I suggested to the Board, a plan which had been under consideration by myself and the engineers in charge of the pumping machinery, for placing a piston engine at the east end of the engine room and connecting it with gearing to the rotary pumps ; said engine to be of sufficient power to run both pumps to their full capacity, which we could not do with the rotary engine in use.

The rotary engine was not of sufficient power to run both

rotary pumps, even when the piston engines were not running, and when the piston engines were running up to their full capacity it was impossible to get steam through the one steam pipe with which all the engines were connected, to run both the piston engines and the rotary engine to anything like their full capacity. It is also a well understood fact that a rotary engine is by no means economical in the use of steam, it requiring at least double the steam to do the same work that a well constructed piston engine will do, while the rotary engine has done all that it was intended for, (which was to be run in case of accident to the piston engines, or when they were shut down for re-packing or for minor repairs,) while the works were running within their guaranteed capacity of 2,000,000 gallons per day, when it passed beyond that point and it became necessary in case of a fire of any magnitude to run the entire works at heavy pressure and very fast, it was not to be relied upon, besides being a heavy drain on our steam capacity it was liable to heat and stick fast, just when it was most required.

At a meeting of the Board held August 5th, I was instructed to examine more fully into the practicability of such an improvement, and report the probable expense to the Board. At the next meeting, held September 2d, I submitted a report, placing the expense if a new cut-off engine were put in at about $3,500.00, and if a second-hand engine of suitable capacity could be procured at a reasonable price at about $2,000. The matter was referred to a Special Committee, consisting of Commissioners Smalley, Bradley and myself, with authority to make the necessary purchases.

The committee succeeded in procuring a good engine at less than my estimate, and I can now report the improve-

ment completed satisfactorily. On the last of December, the rotary pumps were run by the piston engine and everything worked to our entire satisfaction. We can now run both rotary pumps up to fire pressure with nearly the same economy of steam that we can run the old piston engines and pumps when running them high pressure. We have increased the pumping capacity of the works at least 1,000,000 gallons per day. We have increaseed the percentage of safety from accident to the works to an inestimable extent, by having two entirely seperate and independent steam pipes from each boiler to independent engines, and by being enabled to pump a larger amount of water than before, without running the old set of piston engines to the dangerous speed which has been too often necessary.

The entire expense of this addition to the works has been $1,781.10, with a few small items for paint, exhaust pipe unpaid, which will bring the expense up to about $1,800.00. It places the works in a condition that we shall not probably require another set of piston engines in less than four or five years.

STREET PIPEAGE.

Early in the year, petitions for extensions of the street mains began to make their appearance, and as there remained a balance of about $6,500.00 from proceeds of bonds yet to be expended on construction, besides the $1,000 in bonds in the "Fund for the repair of Wyckoff Pipe," which were evidently not going to be required for the use for which they were retained, and inasmuch as the collections from Water Rates had replaced the money borrowed from proceeds of Bonds to pay current expenses in former years before the collections were sufficient to meet such current expenses, and had placed the "Water Works Fund" in good condition, the Board decided that at least

such portions of the city as seemed to require fire protection should be accommodated as far as possible. With this end in view more particularly, the following lines of pipe have been laid, at an entire cost of $3,447.05 :

On Henry Street, from Lord Street to Water Street, with a hydrant at the corner of Henry and Water Streets.

On Woodside Avenue from the alley between Jefferson and Madison Streets to the alley between Washington and Adams Streets, with a hydrant at the corner of Woodside Avenue and Adams Street.

On Center Street from Lincoln Avenue to Trumbull Street, and on Trumbull Street from Center to Ninth Street, with hydrants at the corner of Center and McClellan Streets, Center and Johnson Streets, Center and Pendleton Streets, Center and Trumbull Streets, Trumbull and Seventh Streets and Trumbull and Ninth Streets.

Also from John McEwan's mill east to the Atlantic Salt Works, with a hydrant at the corner of street near Atlantic Salt Campany's barn.

The length of pipe laid has been as follows :

Eight inch iron pipe, (branch castings) - -	9 feet.
Six inch iron pipe, " " -	32¼ "
Four inch iron pipe, " " - -	3½ "
Eight inch Wyckoff pipe, - - - -	40½ "
Six inch Wyckoff pipe, - - - -	5,673 "
Four inch Wyckoff pipe, - - - -	185½ "
Total, - - - - - -	5,943¾ feet.

Or one mile and 663¾ feet.

The number of valves set in these lines of pipe were 14, of the following sizes :

Six inch, 4.
Four inch, 9.
Three inch, 1.

Number of hydrants set, 9, of which 7 are Holly's patent and 2 are Matthews patent, all double discharge, post hydrants.

The whole street pipeage of the city is as follows:

Sixteen inch iron pipe, - - - - -	1,410	feet.
Twelve " " " - - - - -	4,883	"
Ten " " " - - - - -	8,428½	"
Eight " " " - - - - -	1,924	"
Six " " " - - - - -	954¼	"
Four " " " - - - - -	660½	"
Total Iron pipe, - - - - -	18,260¼	feet.

Or three miles and 2,420¼ feet.

Ten inch Wyckoff pipe, - - - - -	6,411	feet.
Eight " " - - -	11,545½	"
Six " " - - - - -	49,160½	"
Four " " - - - - -	17,166	"
Three " " - - - - -	319	"
Total Wyckoff pipe, - - - -	84,602	feet.

Or 16 miles and 122 feet.

Total distributing mains in city, - 102,862¼ feet.

Or 19 miles and 2,542¼ feet.

The 30 inch pipe from the Bay to the Engine House is 4 miles and 66 feet, and 18 inch pipe from the river, 386 feet, making the whole length of pipe laid in connection with the works, 23 miles and 2,994¼ feet.

Number of Valves in distributing mains:

16 inch, - - - - - - -	1
12 inch, - - - - - -	4
10 inch, - - - - - - -	10
8 inch, - - - - - -	25
6 inch, - - - - - - -	71
4 inch, - - - - - -	160
3 inch, - - - - - - -	1
Total, - - - - - -	272
30 inch Valve in pipe from bay, -	1
18 inch Valve in pipe from river, -	1
	274

Number of Hydrants in use :

Holly Hydrants, - - - - -	97
Matthews Hydrants, - - - -	40
Brown Hydrants, - - - - -	1
Total, - - - - - - -	138

All double discharge, post hydrants.

The pipes and hydrants are divided among the different wards of the city as follows :

Ward.	Length of Pipe.	No. of Hydrants.	Assessed Value.
First Ward, -	18,207½ feet.	26	$ 932,000
Second " -	20,894¼ "	22	2,020,000
Third " -	26,957½ "	29	2,045,000
Fourth " -	9,708 "	17	885,000
Fifth " -	9,643½ "	14	645,000
Sixth " -	8,891 "	16	520,000
Seventh " -	8,560¼ "	14	603,000

OFFICE.

The City Council having set apart an office in the new city building for the permanent use of the Board, it was occupied immediately on the completion of the same in January last, and in the spring it was fitted up with stationery desks, suitable table, matting for the floor, &c., making a very convenient and comfortable office.

The expense of fitting up the desks, table, etc., was $168.42.

The amount paid during the year for Superintendent's salary and office expenses was $1,823.36, which is $138.95 less than during the previous year.

LEAKS AND BREAKS.

There have been but seven leaks in the main Pipes during the year. Of these, five were in the Wyckoff pipe and two in the iron pipe.

Of the five leaks in Wyckoff pipe, four were from defective joints, and one from a small knot hole. All were repaired by caulking, and the entire expense was $15.75.

Of the two leaks in the iron pipe, one was from the lead starting in a joint, and was repaired by re-caulking the lead, and one was from a sand hole in the iron, which was repaired by plugging, covering with rust joint cement and fitting a clamp around the pipe. The expense of these re- was $12.83.

Four hydrants were found frozen during the winter of 1878–9, and were at once placed in condition for use.

Five hydrants have been broken during the year, of which two were broken while in use at fires, one was broken by a runaway team, one was broken while in use for flushing sewer, and one was found broken, cause unknown.

The entire amount paid out during the year for repairs of hydrants, valves and pipes, inspection, turning off and on water, cleaning wells, &c., was $184.71, less $8.14 charged Harris & Co., for repairs to hydrant broken by team, making cost of these repairs $176.57, which is $137.27 less than was paid for the same work in 1878.

PUMPING.

The amount paid during the year for pumping expenses, was $6,271.63, which is $169.18 more than was paid in 1878, but the quantity of water pumped during the year exceeded the quantity pumped in 1878 by 142,000,000 gallons.

The entire amount paid during the year for current expenses was $8,357.94, which is $59.48 less than the current expense for 1878.

RECEIPTS AND EXPENSES COMPARED WITH 1878.

The cash collections during the year from water rates have been, - - - - - $11,473.91

And from other sources, - - - - -	469.80
Total, - - - - - -	$11,943.71
Showing an increase in collections from water rates over 1878, of - - - - -	$1,326.16
From other sources, - - - - -	127.85
Total increase over 1878, - -	$1,454.01
Of the cash collections, $11,803.91 can be properly classed as current receipts, being composed of amounts received from water rates,	$11,473.91
Plumber's licenses, - - - - - -	28.75
Rent of boom, - . - - - .	65.00
Sale of scrap material, - - - - -	2.45
Amount received from service taps in excess of amount paid out for same, - - -	233.80
	$11,803.91
Which shows current receipts in excess of current expenses, - - - - - - -	$3,445.97

A net gain over 1878 of $1,503.42.

SERVICE CONNECTIONS.

The number of new service connections put in during the year was 94 of the following sizes :

1 inch connected with iron main, -	5
¾ " " " - -	3
⅝ " " " -	2
½ " " " - -	4
⅜ " " " -	1
2 inch connected with Wyckoff, - -	3
1 " " " - -	13
¾ " " " - -	39
½ " " " - -	24

Of these 19 were for additional supplies to premises be-

fore supplied, two were for city drinking fountains, seventy-three for new services to premises not before using water.

Whole number of service connections with mains 740 of which 158 are connected with iron pipe, and 582 are connected Wyckoff pipe.

WASTE OF WATER.

The whole quantity of water pumped during the year was 672,344,128 gallons, which is 142,146,731 gallons more than was pumped in 1878. The collections for water rates have been about one and seven-tenths cents per thousand gallons while the collections for water rates in 1878 were about one and nine-tenths cents per thousand gallons. This shows that the waste of water is increasing quite as rapidly as its legitimate use, and some means should be adopted to put a curb on such waste. The only plan I can suggest aside from the use of meters is the employment of an inspector to spend his entire time in examining premises where the water can be allowed to run to waste. But this plan I have but little faith in, consumers soon learning plans for getting over the inspection successfully, with but little curtailment of the waste.

The general use of water meters must be adopted, or our system of pipes will soon be too small to supply the demand and those portions of the city most remote from the engine house will not be able to secure a proper supply of water.

In my last report I called your attention to the waste of water largely indulged in by consumers, and recommended the use of meters to restrain this waste. Owing to the large expense which would be incurred by their general use the recommendation was not carried out, and no abatement of this waste has been secured.

"FUND FOR REPAIRS OF WYCKOFF PIPE."

In my last report I recommended that the $1,000 bonds in the hands of the treasurer of the board be sold, and the proceeds be used in laying pipe, that being the purpose for which the bonds were voted. This has been done. One $500 bond being sold under instructions from the board at the meeting held June 11, 1879, and the other as per resolution November 11, 1879. The amount received by the Treasurer for premium and accrued interest on these bonds was $269.73. This amount being placed to the credit of the "fund for the repair of Wyckoff pipe" made the balance in that fund $1,153.25.

In accordance with instructions from the board November 11, 1879, I placed this amount to the credit of "Wyckoff pipe" account and cancelled the "fund for the repair of Wyckoff pipe."

The money received for these bonds has been used in payment for pipe, valves and hydrants, which is the reason that a considerably less amount has been withdrawn from "water works funds" than has been paid out during the year.

BALANCE IN TREASURY.

The balance in the "Water Works Fund" January 1st, 1879, was - - - - -	$ 5,366	58
Add cash collections deposited with City Treasurer and credited to that Fund, - -	11,943	71
	$17,310	29
And deducting amount withdrawn from that fund by the requisition on the Recorder,	$12,500	00
Leaves a balance in the "Water Works Fund," December 31st, 1879, of - - -	$4,810	29

A decrease of $556.29.

The balance in the hands of the Treasurer of the Board, January 1st, 1879, including the $1,000 in Bonds at their face value, was - -	$ 1,533	42
Adding amount rec'd from Water Works Fund,	12,500	00
And amount received for premium and accrued interest on bonds sold, - - -	269	73
	$14,303	15
And deducting amount of orders drawn on the Treasurer during the year, - - -	13,975	06
Leaves a balance in his hands, Dec. 31, 1879,	$328	09

A decrease of $1,205.33.

Itemized statement of receipts and disbursements :

RECEIPTS.

From Water Rates, Roll of 1877,	$ 65 78		
" Water Rates, Roll of 1878,	260 34		
" Water Rates, Roll of 1879,	11,147 79		
		$11,473	91
" Plumber's Licenses,		28	75
" Rent of Boom,		65	00
" Sale of Scrap Material,		2	45
" Sale of Service Taps,		373	60
		$11,943	71

These collections have been by months as follows :

January,	$1,224 27	July,	$1,984 96
February,	400 20	August,	369 12
March,	547 92	September,	859 70
April,	1,520 84	October,	1,678 96
May	577 06	November,	700 70
June,	834 10	December,	1,245 88
			$11,943 71

And have been deposited with the City Treasurer to be placed to the credit of the "Water Works Fund" as follows:

1879.	
January 31,	$1,224 27
February 28,	400 20
March 31	547 92
April 14	1,000 00
" 30	520 84
May 31	577 06
June 30	834 10
July 9	500 00
" 14	500 00
" 23	500 00

July 31	484 96	
August 30	369 12	
September 30	859 70	
October 18	1,000 00	
" 31	678 96	
November 29	700 70	
December 31	1,245 88	
		$11,943 71

Amounts withdrawn from the "Water Works Fund," by requisition on the Recorder, as provided by Ordinance :

Requisition No. 118,	dated	Jan'y 1, 1879,	$ 750 00	
" " 119,	"	Jan'y 31,	750 00	
" " 120,	"	Feb. 28,	750 00	
" " 121,	"	Mar 31,	750 00	
" " 122,	"	April 30,	700 00	
" " 123,	"	May 31,	700 00	
" " 124,	"	June 30,	700 00	
" " 125,	"	July 31,	700 00	
" " 126,	"	Aug. 30,	700 00	
" " 127,	"	Sept. 30,	2,000 00	
" " 128,	"	Oct. 31,	2,000 00	
" " 129,	"	Nov. 29,	2,000 00	
				$12,500 00

Which has been at once deposited with the Treasurer of the Board, who, in addition to the above amount has received the $269.73 before mentioned, from premium and accrued interest on $1,000.00 bonds sold which last mentioned amount was paid to the Treasurer direct without passing through this office.

DISBURSEMENTS.

The whole amount expended with the Board during the year, was $13,975.06, for the following general accounts :

For Superintendents and Secretary's salary and office expenses,	$1,823 36	
" Repairs and care of Hydrants, Valves, Pipes, &c.,	176 57	
" Repairs to Engine House,	22 09	
" Implements on Repairs and Engineer's Tools,	64 29	
Total Current Expense, except for Pumping,		$2,086 31
For Engineer's and Firemen's Wages,	$3,300 00	
" Fuel account,	2,347 30	
" Oil, Packing and Engineers Supplies,	376 24	
" Repairs to Pumping Machinery,	206 29	
" Repairs to Boiler Arches,	41 80	
Total Pumping Expenses,		$6,271 63
Total Current Expenses,		$8,357 94

For Service Tap account,	$ 139 80		
" Water Meters,	68 75		
Total Service Taps and Meters,			$208 55
" Office Furniture,	$ 168 42		
" Engine Foundations,	317 96		
" Pumping Machinery,	1,463 14		
" Valves for Street Mains,	172 02		
" Public Fire Hydrants,	310 99		
" Iron Pipe and Branch Castings,	100 12		
" Wyckoff Pipe,	2,283 89		
" Laying Pipe,	580 03		
" Implements used only on Construction,	12 00		
Total Construction account,			$5,408 57
			$13,975 06

The items of these expenditures have been for Superintendent's and Secretary's salary and office expenses, as follows :

Superintendent and Secretary's Salary, Dec. 1, '78, to Dec. 1, '79,	$1,500 00	
Assistance to Secretary, Dec. 1st, 1878 to April 1st, 1879,	75 00	
Rent of office from April 26, 1878 to Jan. 16, 1879,	126 39	
Accountants Examining Secretary's books for 1878,	25 50	
Printing Superintendent's Report for 1878,	20 00	
Blanks, Letter Heads, Stationery, Ink, &c	22 25	
Gas Bill, (old office,)	2 35	
Coal for Office, 1878-9 and 1879-80,	28 50	
Moving Safe and Office Furniture,	8 77	
Repairs to Office Furniture,	10 90	
Tin Trunk for Filing Papers in Vault,	2 25	
Carrying up coal and discount on sundry drafts, (paid by Sec)	1 45	
		$1,823 36

Repairs and care of Hydrants, Valves, Pipes, &c :

Labor on Repairs to Wyckoff Pipe,	$15 75	
" " " Iron Pipe	7 33	
Machine Shop Repairs to Iron pipe	5 50	
Labor on Repairs to Hydrants, Valves, Cleaning Wells and turning on and off water	92 71	
Machine Shop Repairs to Hydrants and Valves,	27 32	
Hose Couplings for changing in hydrants	21 60	
Hydrant for Street Sprinkler Cart	12 00	
Teaming	2 50	
		$184 71
Less amount charged Harris & Co., and deducted from their bill, for breaking hydrant	$8 14	
		$176 57

Repairs to Engine House :

Labor on Sewer	$ 3 00	
" Oil Safe and Cupboard	6 00	
Lumber	11 23	
Nails, Screws, &c	1 86	
		$22 09

Implements on Repairs and Engineers Tools :

Punches, Wreches, Pipe Tongs, Files and Small Tools for Engineers	$45 44	
Wheelbarrow	2 00	
Chisels and Wrenches for Tapper	4 20	
Hose Bibb and Coupling for Pressure Guage	2 20	
Repairing Old Tools	10 45	
		$64 29

Engineer's and Firemen's Wages :

First Engineer's Salary, Dec. 1st, 1878 to Dec. 1st, 1879	$1,200 00	
Second " " " " " "	900 00	
Two Firemen, " " " " " "	1,200 00	
		$3,300 00

Fuel Account :

Rouse Brothers, 827 cords Slabs delivered as per contract of November 11th, 1878	$ 827 00	
Rouse Brothers, 1500 cords Slabs on their yard as per contract of May 5th, 1879	1,125 00	
Hauling 1500 cords from Rouse Bros	395 30	
Dolson, Walker & Co., and Dolson, Chapin & Co., 115 cords of Slabs delivered	115 00	
		$2,462 30
Less amount charged Dolson, Walker & Co., and Dolsen, Chapin & Co., for Rent of Boom and Dock	$ 115 00	
		$2,347 30

Oil, Packing and Engineer's Supplies:

95 gallons Cylinder Oil and Freight	$48 67	
104 " Lard Oil	56 78	
10 " Engine Oil and Freight	5 75	
10 " Valveoleum and Can	8 00	
12¼ lb Rubber Valve for Air Pump	12 25	
30⅛ lb Sheet Rubber	7 77	
46 lb Square Rubber	27 08	
10¾ lb Heston Packing and Freight	16 88	
36 lb Cotton Packing	14 40	
16 lb Hemp Packing	4 00	
1348 lb Hemlock Extract	53 92	
201½ gallons Kerosene Oil	39 50	
6 lb Candles	1 25	
Wicks and Wicking	1 22	
Lantern Globes	1 05	
786½ lb Wiping Rags	55 06	
9½ lb Cotton Waste	1 19	
Concentrated Lye, Oxalic Acid, Tripoli, Rotten Stone, &c.	5 00	
1 dozen Brooms	2 50	
Rope, Cord, Wire, Wire-Cloth, Sheet Copper and Brass	6 96	
Emery and Emery-Cloth	3 39	
White and Red Lead, Oil, Asphaltum, &c	3 61	
		$376 24

Repairs to Pumping Machinery :

Repairing Boiler Flues	$55 18	
New Valve Stems and Cut-off Stems	30 67	
New Piston Rod in Air Pump	13 15	
New Brasses for Connecting Rod	13 37	
New Oiler for High Pressure Cylinder	12 00	
Iron, Bolts and Leather for Pump Valves	32 56	
Levers for Suction Valves to Rotary Pumps	4 62	
Repairing Cut-offs, Stuffing Box and Piston Springs	13 34	
Bolts, Rivets, Screws, Flanges	12 00	
Gas Pipe and Globe Valves	14 91	
Straps and Clamps for repairing Steam Pipe	3 49	
Teaming	1 00	
		$206 29

Repairs to Boiler Arches :

Iron Plate for Bridge Wall	$ 3 05	
Brick and Clay for Lining Arches	19 75	
Mason Work, Repairing Arches	19 00	
		$41 80

For Service Taps :

Paid for Two 2 inch Connections	$ 6 00	
" Four dozen ¾ inch Connections and	54 60	
" Repairing 6 Broken Taps	6 50	
" Screws and Iron for Bands	2 45	
" Labor, Putting on Taps	70 25	
		$139 80

For Water Meters :

Paid Union Water Meter Co., for One ⅝ inch Rotary Meter and Box	$15 75	
" " " " One ¾ " " "	21 00	
" " " " One 1 " " "	32 00	
		$68 75

For Office Furniture :

Stationary Desks and Screen	$130 89	
Sable and Copying Press Stand	19 50	
Matting for Floor	13 30	
Gas Fixtures	1 08	
Duster, &c., for Office	3 65	
		$168 42

For Engine Foundations :

Brick, Stone and Mason Work	$ 90 87	
Cement	11 20	
Cut Stone Coping	171 15	
Girders in Foundation	39 74	
Templet for Setting Bolts	5 00	
		$317 96

For Pumping Machinery :

One 18x22 Piston Engine to run Rotary Pumps	$850 00	
Pillar Block for out-end of Shaft	31 85	
Steam Pipe from Boilers to New Engine	216 75	
Gears and Bearings for gears to connect Engine with Pumps	242 87	
Holding Down Bolts for New Engine, and Lead for fastening same	54 29	
Exhaust Pipe	6 28	
Lever and Shaft for operating throttle from in front of main engine.	40 72	
Gas Pipe, Globe Valves and Bolts	10 06	
Teaming	10 32	
		$1,453 14

For Valves for Street Mains :

Two 6 inch Valves	$ 40 00	
Nine 4 "	117 00	
Freight and Cartage	1 93	
Valve Cases and Covers	13 09	
		$172 02

For Public Fire Hydrants :

Paid for 6 Holly Hydrants, 4 ft. case	$225 00	
" 2 " " 4 ft. 9 inch case	80 00	
" Freight and Cartage	5 99	
		$310 99

For Iron Pipe and Branch Castings :

Twelve 6x4 Tees	$93 56	
One 4x4 Tee	5 06	
Putting Stay-bolt in Casting	1 50	
		$100 12

For Wyckoff Pipe :

402½ ft. 8 inch Wyckoff Pipe @ 50 cents	$ 20 25	
4763 ft. 6 " " " @ 37½ cents	1,786 12	
895 ft. 6 " " " @ 45 cents	402 75	
167½ ft. 4 " " " @ 25 cents	41 87	
18 ft. 4 " " " @ 30 cents	5 40	
Three 6 inch Sleeves	18 00	
Plugs and Extra Thimbles	9 50	
		$2,283 89

For Laying Pipe :

Labor making Iron Connections	$ 2 88	
Trenching for and Laying Wyckoff Pipe	567 64	
Machine Shop Boring Out Castings and Valves	4 26	
Teaming	5 25	
		$580 03

Implements used on Construction:

Pipe Driver and Driving Heads	$12 00

WATER PUMPED AND COST OF PUMPING.

The quantity of water pumped during the year, was, - - - 672,344,128 gallons.

Of which 666,065,088 gallons were pumped at the ordinary domestic pressure of 40 lb per square inch at the level of the pressure guage, which is equivalent to a litt of 107 feet from the level of the water in the wells.

4,913,040 gallons were pumped at an average fire pressure of 90 lb per square inch at the guage, equal to a lift of 223 feet, and 1,366,000 gallons were pumped at an average pressure of 75 lb per square inch at the guage, equal to a lift of 188 feet, for compressing air in tank to bell-striker in second ward engine house tower.

The following statements show the quantity and cost of material used in running the pumping engines during the year :

On hand January 1st, 1879 :

31 cords of Slabs, costing		$31 00
3 gallons of Lard Oil, costing		1 95
25 " Cylinder Oil, costing		24 50
23 lb of Rubber Packing and Sheet Rubber		16 50
Hemlock Extract		6 00
25 gallons of Kerosene Oil		5 87
30 Lamp Chimneys		2 50
Globes, Wicks and Wicking		83
40 lb Wiping Rags		2 80
Oxalic Acid, Concentrated Lye, Tripoli and Rotten Stone		1 67
Broom		18
		$93 80

Delivered at works during the year :

2,442 cords of Slabs,	costing	$2,462 30	
104 gallons of Lard Oil,	"	56 78	
95 " Cylinder Oil,	"	48 67	
10 " Engine Oil,	"	5 75	
10 " Valveoleum,	"	8 00	
88¾ lb Rubber Valves, Sheet Rubber and Packing,	"	47 10	
62¾ lb Piston Packing,	"	35 28	
1348 lb Hemlock Extract,	"	53 92	
201⅛ gallons Kerosene Oil,	"	39 50	
Candles, Wicks, Wicking and Globes,	"	3 53	
796 lb Wiping Rags and Waste,	"	56 25	
Concent'd Lye, Oxalic Acid, Tripoli, Rotten Stone, &c.,	"	5 00	
One dozen Brooms,	"	2 50	
Rope and Cord, Wire, Wire Cloth, Copper and Brass,	"	6 96	
Emery and Emery Cloth,	"	3 39	
White and Red Lead, Oil, Asphaltum, &c.,	"	3 61	
			$2,838 54
Total to be accounted for,			$2,932 34

Used during the year :

2,433 cords of Slabs,	costing	$2,453 30	
92 gallons of Lard Oil,	"	50 48	
120 " Cylinder Oil,	"	73 17	
10 " Engine Oil,	"	5 75	
8 " Valveoleum Oil,	"	6 40	
83¾ lb Rubber Valves, Packing, &c.,	"	43 50	
32¾ lb Piston Packing,	"	19 98	
Hemlock Extract,	"	41 12	
207½ gallons Kerosene Oil,	"	41 67	
Candles, Wicks, Wicking, Chimneys and Globes,	"	5 11	
826 lb of Wiping Rags and Waste,	"	58 35	
Concentrated Lye, Oxalic Acid, Tripoli and Rotten Stone,	"	5 37	
9 Brooms,	"	1 85	
Rope and Cord, Wire, Wire Cloth, Copper and Bass,	"	6 96	
Emery and Emery Cloth,	"	1 84	
White and Red Lead, Oil, Asphaltum, &c.,	"	3 61	
Total Used			$2,318 46

On hand December 31st, 1879:

40 cords of Slabs,	costing	$40 00	
15 gallons of Lard Oil,	"	8 25	
2 " Valveoleum Oil,	"	1 60	
281 lb of Rubber Valves and Packing,	"	20 10	
301 lb of Piston Packing,	"	15 30	
4701 lb of Hemlock Extract,	"	18 80	
19 gallons of Kerosene,	"	3 70	
21 Lamp Chimneys,	"	1 75	
101 lb Wiping Rags,	"	70	
Tripoli and Rotten Stone,	"	1 30	
4 Brooms,	"	83	
21 lb Emery and 1 quire Emery Cloth,	"	1 55	113 88
Total accounted for,			$2,932 34
Taking value of material used as above,		$2,318 46	
And adding Engineer's and Firemen's Wages,		3300 00	
Repairs to Pumping Machinery,		206 29	
Repairs to Boiler Arches,		41 80	
Makes total cost of pumping,			$6,366 55
Cost per million gallons pumped,		$ 9 47	
" " raised 100 feet,		8 77	
Cost of Fuel per million gallons pumped,		3 65	
" " raised 100 feet,		3 38	
Taking total cost of Pumping as above,		6,366 55	
And adding Supt's and Sec'ys Salary and Office Expenses,		1,823 36	
Repairs and care of Hydrants, Valves and Pipes,		176 57	
Repairs to Engine House,		22 09	
Implement account on repairs,		64 29	
Makes a total for current expense,			$8,452 86
Which is, per million gallons pumped,		$12 57	
" " " raised 100 feet,		11 64	

The following table shows the quantity of water pumped during each month of the year, number of hours run for fire, number of hours run by Rotary Engine, and number fire alarms received at the engine house :

Month.	No. gals. pumped by piston engine at 40 lbs. pressure.	No. gals. pumped by rotary engines at 40 lbs. pressure.	No gals. pumped at 75 pounds pressure to fill air tank.	No. gals. pumped at fire pressure, average 90 lbs.	Total No. gallons pumped.	No. hours run by rotary.	No. hours run for fire.	No fire alarms
January,	41,440,000	1,376,000	.....	243,000	43,059,0 0	23	2 10	4
February,	42,972,000	120,000	.....	120,000	41,112,000	2	1 30	9
March,	42,562,000	240,000	.....	686,000	41,486,000	3	6 00	4
April,	47,776,000	80,000	.....	1,433,440	49,289,440	1	10 3	8
May,	51,220,000	1,048,000	.....	180,000	52,440,000	12	30	5
June,	54,084,000	436,000	.....	.....	54,520,000	5	.....	2
July,	74 152,000	360,000	427,000	781,000	75,719,000	3	5 00	12
August,	61,568,000	400,000	363,000	736,000	63,067,000	4	3 30	5
September,	66,4 4,000	800,000	216,000	56,000	67,476 000	6	30	3
October,	63,928.000	75 ,000	144,000	421,000	65,230,000	7	3 00	3
November,	59.124,000	1,100,000	216,000	210,600	61,650,600	11	1 30	3
December,	57,795,088	460,000	.....	40,000	58,295,088	3½	20	3
Total,	658,093,088	7,162,000	1,366,000	4 913 04	672.344,128	80½	34 30	61

WATER RATES ASSESSMENT AND WATER SUPPLY.

The regu ar assessment roll for 1880 amounts to $9,500 00
Estimated amount to be received from mills, building purposes and other than regular consumers, - - - - - - - 2,500 00

Total estimated receipts from roll of 1880, $12,000 00

Besides which there is uncollected,

On roll of 1878, - - - $360 46
On roll of 1879, - - - 697 25

Of which I consider $600 collectable.

The following table shows amount collected, amount uncollected and total amount on roll for each year since the works commenced operation :

Years Assessment.	Amount Collected.	Amount Uncollected.	Total of Roll.	Per Cent. Uncollected.
1873. Jan 1st to April 30th,	$ 728 82	.....	$ 728 82	.....
1873-4, May 1st to April 30th,	5,440 80	$ 1 60	5,442 40	.....
1874-5, May 1st to April 30th,	6,908 16	44 85	6,953 01	00.64
1875. May 1st to Dec. 31st,	7,269 55	28 46	7,298 01	00.39
1876,	9,571 26	82 73	9,653 99	00.85
1877,	9,599 26	139 19	9,738 45	01 45
1878,	10, 42 40	360 46	10,402 86	03.46
1879,	11,147 79	697 25	11,845 04	05.89
Total,	$60,708 04	$1,354 54	$62,062 58	02.18

The assessment for 1880 is for the following uses of water:

346 Dwellings.
176 Lawn hose.
71 Private baths.
139 Private water closets and urinals.
89 Private families in bl'ks.
54 Private stables.
4 Bakeries.
3 Banks.
6 Barber shops.
3 Bath houses, (public)
4 Blacksmith shops
21 Boarding houses.
3 Bottling works.
17 Butcher shops.
1 Brewery.
2 Churches.
1 Court House.
1 Express office.
1 Flouring mill.
1 Gas works.
3 Harness shops.
1 Hose for cleaning tug boilers.
1 Hospital.
20 Hotels.
3 Hotel barns.
1 Jail.
1 Library building.
10 Livery stables.
3 Halls and lodge rooms.
3 Machine shops and foundries.
8 Mill stables.
51 Offices.
1 Post office.
3 Paint shops.
2 Passenger depots.
3 Photograph galleries.
1 Pin factory.
5 Planing Mills.
2 Printing Offices.
26 Private hydrants.
19 Private hose for fire protection.
69 Public water closets or urinals.
6 Restaurants.
2 Root beer factories.
1 Round house.
67 Saloons and bars.
1 Sale Stable.
1 Salt crusher.
5 School buildings.
1 Slaughter house.
6 Sleeping rooms in bl'ks.
62 Stores
1 Street car barn.
1 Steam laundry.
1 Telegraph office.
1 Warehouse.
3 Water motors.

Besides the following described uses where water is used

only a portion of the season, and the rates is assessed for the time the water is used :

7 Saw mills.
5 Salt blocks.
13 Drill houses.
6 Saw mills using water for cleaning boilers only.
1 Pipe works.
1 Spoke factory.
5 Fountains.
2 Salt blocks using water for slaking lime, etc.

Water is supplied for the following uses for which no assessment is made :

1 Round-house and railroad repair shop.
1 City building, police station and city offices.
3 City hose houses.
11 Public drinking fountains.
2 Ornamental fountains in public squares.
138 Public fire hydrants kept in repair and working order at expense of the water works.

The supply is shut off from 81 services, as follows :

12 Premises where buildings burned and not re-built.
4 Premises where buildings removed.
3 New services not compl'd.
27 Dwellings.
3 Pasture lots.
8 Stores, shops and offices.
3 Hotels & boarding houses.
2 Stables.
3 Manufactories.
2 Butcher shops.
14 Hose and street sprinklers.

LEDGER BALANCES.

The following balance sheet shows the ledger balances from the commencement of the construction of the works, to the first day of January, 1880 :

As will be seen from this balance sheet the amount received from city bonds, for construction, being proceeds of $377.000 bonds sold, is - - - - - - - -	$368,045 87
And total Dr. balances on construction, -	365,645 06
Leaving balance for use on construction,	$2,400 81
The balance in the " Water Works Fund," is	$4,810 29
Deducting amount available for construction, -	2,400 81
Will leave a balance in the fund, of -	$2,409 48

Which I consider a sufficient margin to leave in the fund to cover any extraordinary repairs.

In the future, any excess of collections from water rates over current expenses, can be used either to assist in paying the interest on the bonded debt, or to create a Sinking Fund to aid in retiring the bonds when they fall due.

DR. BALANCE.

Real Estate	Folio	422	$ 6,724 83
Dock, Tramway and Store Shed	"	422	1,882 63
Engine house chimney and wells	"	423	19,097 42
Engine foundations, boiler foundations and arches	"	423	4,941 72
Inlet from river	"	424	3,218 99
Inlet from bay	"	428	84,778 37
Reservoir and breakwater at bay	"	429	21,491 78
Filter at bay	"	429	1,683 13
Pumping machinery	"	424	38,957 43
Iron pipe and branch castings	"	425	12,746 95
Wyckoff patent pipe	"	425	67,683 68
Laying iron pipe	"	425	14,462 42
Laying Wyckoff pipe	"	426	17,424 75
Valves for street mains	"	427	8,544 81
Public fire hydrants	"	427	7,274 99
Furniture and fixtures	"	432	601 92
Implements used on construction	"	429	1,713 61
Interest, discounts and commissions	"	431	4,224 17
Insurance on construction	"	431	29 00
Engineering and general superintend	"	430	7,856 17
Travelling expenses	"	430	306 29

Water meters	Folio 408	$71 48		
Service stop boxes	" 408	13 20		
			$365,729 74	
Water works fund	" 402	4,810 29		
Orrin Bump, treasurer of board	" 466	328 09		
			$ 5,138 38	
Office expense and salary account	" 409	11,831 44		
Engineer's and firemen's wages	" 410	24,391 67		
Fuel account	" 411	15,367 19		
Repairs to pumping machinery	" 413	1,221 48		
Oil, packing and engineer's supplies	" 414	2,712 03		
Repairs to boiler arches	" 413	122 57		
Repairs to engine house and insurance	" 415	273 21		
Repairs and care of hydrants, valves and pipes	" 418	3,495 17		
Repairs to reservoir and breakwater	" 417	55 00		
Implements for repairs	" 416	452 02		
			$ 59,921 78	
Rorison & McKinney	" 438	19 40		
Campbell & Church	" 437	4 00		
Thomas Rosa	" 437	15 57		
A. L. Stewart	" 436	15 00	53 97	
Total Dr. balance,			$430,843 87	

CR. BALANCE.

Bay City Bond account, ($377,000 bonds,)	Folio 421		$368,045 87
Water Assessment Frontage on pipe,	" 421		736 07
Service Tap account,	" 466		573 11
Plumbers Licenses,	" 401		138 45
Rents, Dockage, &c.,	" 401		642 33
Water Rates—Roll of 1872-3,		$ 728 82	
" " Roll of 1873-4,		5,440 80	
" " Roll of 1874-5,		6,908 16	
" " Roll of 1875, 8 months,		7,269 55	
" " Roll of 1876,		9,571 26	
" " Roll of 1877,		9,599 26	
" " Roll of 1878,		10,042 40	
" " Roll of 1879,		11,147 79	$60,708 04
Total Cr. Balance,			$430,843 87

The books of the office were examined thoroughly by experienced accountants at the commencement of the year, and found to be correct.

I would respectfully ask that accountants be selected to make a similar examination for the year embraced in this report.

Respectfully submitted,

E. L. DUNBAR,

Secretary and Superintendent.

Bay City, January 13, 1880.

NINTH ANNUAL REPORT

OF THE

SUPERINTENDENT OF WATER WORKS

TO THE

Board of Water Commissioners

OF

BAY CITY, MICH.,

FOR 1880.



Jno. Grahl, Printer, Bay City.

NINTH

ANNUAL REPORT

OF THE

SUPERINTENDENT OF

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TO THE

Board of Water Commissioners

OF

BAY CITY, MICH.,

FOR 1880.

BAY CITY, MICH.:
JAS. GRAY, PRINTER AND STATIONER.
1881.

Organization, January 1st, 1881.

President, WM. WESTOVER.

First Ward, - -	ANDREW WALTON.
Second Ward, - -	THOMAS CRANAGE, JR.
Third Ward, - -	WM. WESTOVER.
Fourth Ward, - -	WM. SMALLEY.
Fifth Ward, - -	CHAS. E. YOUNG.
Sixth Ward, - - -	WM. DAGLISH.
Seventh Ward, - -	GEO. C. MEYERS.

Superintendent and Secretary, -	E. L. DUNBAR.
First Engineer, - -	A. B. VERITY.
Second Engineer, - -	FRED. H. HOLLY.

LIST OF MEMBERS OF THE

BOARD OF WATER WORKS,

FROM DATE OF ORGANIZATION.

FIRST WARD.

MICHAEL DAILY, appointed Sept 6th, 1871; resigned May 13th, 1872.
ANDREW WALTON, appointed May 27th, 1872.
ANDREW WALTON, re-appointed December 9th, 1872.
ANDREW WALTON, re-appointed Feb. 4th, 1878; term expires Sept. 6, 1882

SECOND WARD.

JAMES SHEARER, appointed Sept. 6th, 1871; term expired Sept. 6th, 1873.
THOS CRANAGE, Jr., appointed Nov. 3rd, 1873.
THOS. CRANAGE, Jr., re-appointed Sept. 2, 1873; term expires Sept. 6th, 1883.

THIRD WARD.

WM. WESTOVER, appointed Sept. 6th, 1871.
WM. WESTOVER, re-appointed March 29th, 1875.
WM. WESTOVER, re-appointed Oct. 20th, 1879; term expires Sept. 6th, 1884.

FOURTH WARD.

JOHN McDOWELL, appointed Sept. 6th, 1871; died May 11th, 1872.
WM. SMALLEY, appointed May 27th, 1872.
WM. SMALLEY, re-appointed Feb. 4th, 1878.
WM. SMALLEY, re-appointed Dec 13th, 1880; term expires Sept. 6th, 1885

FIFTH WARD.

HENRY M. BRADLEY, appointed Sept. 6th, 1871.
HENRY M. BRADLEY, re-appointed Feb. 4th, 1878; resigned May 3rd, 1880.
CHAS. E YOUNG, appointed June 21st, 1880; term expires Sept. 6th, 1881.

SIXTH WARD.

ANDREW J. MILLER, appointed Aug 4th, 1873; term expired Aug. 4th, 1874.
JAS. CLARK, appointed Oct 13th, 1874; term expired Aug. 4th, 1879.
WM. DAGLISH, appointed Oct. 20th, 1879; term expires Aug. 4th, 1884.

SEVENTH WARD.

THOS. H McGRAW, appointed Aug 4th, 1873; resigned Sept. 14th, 1874.
WM. C. McCLURE, appointed Sept. 21st, 1874.
WM. C. McCLURE, re-appointed Nov. 8th, 1875; resigned March 24th, 1879.
GEO. C. MEYERS, appointed May 5th, 1879.
GEO. C. MEYERS, re-appointed Dec. 13th, 1880; term expires Aug. 4th, 1885.

To the Honorable Board of Water Works of Bay City, Michigan:

GENTLEMEN:—In compliance with the regulations of the Board, I have the honor to submit my report for the year ending December 31st, 1880.

The labors of the year have been confined entirely to operating the works; no extensions or enlargements having been prosecuted during the year. The only payments made on construction accounts having been a few small items for completing work commenced in 1879, and nearly completed at the close of that year. These items will appear under their proper head, among the disbursements in the itemized statements embraced in this report.

The total length of main and distributing pipes remain the same as at the date of my last annual report, and it is unnecessary to repeat the details of the length of different sizes of mains, but for the information of such as have not that report at hand, the total length of different kinds of pipe is given:

Thirty inch wooden stave pipe, from Bay to Engine House, - - - 4 miles and 66 feet.

Eighteen inch wooden stave pipe, from River to Engine House, - - - - - 386 feet.

Cast iron distributing mains in the City, 4 to 16 in. in diameter, - 3 miles 2420½ feet.

Wyckoff patent pipe, 3 to 10 in. in diameter, - - - - - - 16 miles 122 feet.

Total pipage in connection with works not including service pipes and pipes laid on pri-

vate property at private expense, 23 miles 2994¼ ft.
The number of stop-valves set and in use, is - 274
The number of public fire hydrants, - - - 138

The pipes have given but little trouble during the year; most of the labor on this branch of the works having been for keeping stop-valves and fire hydrants in working order, the fire hydrants especially requiring considerable care to always maintain them in working order. There has been but four leaks in the main pipes during the year, of which two were in the cast iron pipe, caused by the lead starting in the joints, and two were in the Wyckoff pipe, caused by defective or shakey pipe. The two leaks in the iron pipe were repaired by re-caulking the lead joints; the leaks in the Wyckoff pipe were repaired by inserting new pipe. The cost of the repairs on the iron pipe was $12.00, and on the Wyckoff pipe $38.04.

The entire amount paid for repairs and care of hydrants, valves and pipes, was $347.43, of which $27.62 was for work done and material furnished private individuals, and which has been paid back as appears in cash collections, leaving a balance of $319.81, which is $143.24 more than was paid in 1879 for this work. A large portion of this extra expense has been incurred during the last two months of the year in protecting the hydrants and keeping them clear of frost. Notwithstanding the care and diligence exercised in that direction, a number of fire hydrants have already been found frozen, and should the present severe weather continue much longer without a fall of snow, some of the main pipes will be endangered.

The cost of running the pumping engines has been considerably increased over any previous year since the works commenced operations, the amount paid

for this service being $8,283.13. Of this amount $275 was for engineer and firemen's wages for December, 1879, not paid until January, 1880, leaving actual cost of running for the year, including repairs, $8,008.13, which is $1,736.50 more than was paid in 1879. Of this excess nearly $1,300,00 is for fuel alone, and nearly $100.00 for oil and packing account, the balance being for rebuilding boiler arches in December, which was found to be necessary and which will not probably be required to be done again in several years.

The large excess in the fuel account for the year, over former years, requires more than a passing notice. During the wet weather of the early part of the year it was impossible to procure slabs at a reasonable price, which were in a suitable condition for burning, the roads being in such a condition that the cost of moving the slabs was nearly as much as the first cost of the wood, and during several months the fuel used was such as could be procured conveniently without much reference to quality, and was frequently in such condition as to require firing under all the boilers all of the time. The quantity of water pumped has also increased to such an extent that when the fuel was in good condition, it has been necessary during nearly the entire year to keep full steam pressure on two boilers all of the time, and the third boiler filled with hot water ready in case of fire, for use in a few minutes.

As soon as navigation opened last spring, a cargo of coal was ordered from Toledo for the purpose of testing the relative cost of coal and slabs. This coal was not received until August, but as soon as received, its use was commenced and a careful record kept of the work performed by it. The result of this test was, that

nothing could be saved by burning coal at the price paid, as long as good pine slabs could be procured at the prices paid during the past year, if they could be procured in good condition for burning. The coal would, however, have shown a better result if it could have been protected from the weather until burned. The cargo lasted about two months, and was exposed to several severe rain storms during that time. Before it was all consumed it began to show the effects of the exposure, and there was a very perceptible falling off in its value as fuel. Should there be any difficulty in procuring slabs during the coming season, and it should be found advisable to procure coal, the dock should be covered in, and before this is done it should be replanked entire, and some of the stringers should be replaced with new timbers.

The legitimate increase in the water consumption has been quite as much during the year as could be expected, the collections from water rates reaching $13,365.14, which is $1,891.23 more than was collected from water rates in 1879, but the waste of water has increased in a still larger proportion. The record kept by the engineers shows that 827,067,372 gallons of water were pumped through the mains during the year. an increase of 154,723,244 gallons, or more than 23 per cent. over 1879. The addition made in 1878 has enabled the pumping machinery to meet this increased demand without serious inconvenience, but the outrageous and useless waste of water practiced by some consumers during the past year has crippled the works in a direction of the greatest importance to property owners, especially those owning property along the river towards the south end of the city. The large number of services of large size taking water from the

ten inch main lying on Water street, has been such a drain upon that pipe as to render it impossible to procure good fire service from it, and while the pumping machinery has invariably responded as usual to every fire alarm and been able to maintain at the engine house the full fire pressure, the streams thrown at the location of the fire have not been satisfactory and unless suitable remedies are applied at once the results during the coming season will, without doubt, be very disastrous. The most effective remedy will be the one heretofore recommended, of placing meters on all large services and requiring each and every consumer to pay for every gallon of water passing through their pipes at the rate fixed by ordinance. This recommendation has not met with favor up to this time, owing to the expense it would oblige either the city or the consumers to incur, and if it should not be adopted, the next plan would be to request the mills so located as to be readily accessable to the river for a supply of water, to take their supply for every purpose except fire protection, from the river, thereby cutting off a number of two and three inch openings which are running constantly. It will also be necessary to maintain a strict watch over all premises where hydrants and large openings for hose are located in order to more strictly enforce the ordinance regulating the use of fire hose for other purposes than fire protection. This can be done through the police force of the city without much difficulty, if the policemen are thoroughly informed as to the terms of the ordinance. and instructed to see that these terms are not violated. If neither of these remedies are applied it will be necessary at once to lay a 10 inch main pipe connecting

with the 16 inch main or Water Street at the foot of Belinda Street, and running on Belinda and Johnson street to the end of Center street at least, and it *should* extend to Tenth street. An eight inch pipe should be laid from Tenth street south to the Seventh ward connecting with the header pipes on Thirteenth, Eighteenth, Twenty-fourth, Fremont and South Center streets, with a line connecting it with the present eight inch pipe at McGrawville. In case this additional main pipe should be laid it will probably so increase the supply towards the southern part of the city as to render necessary at once a new and larger set of pumping machinery, including boilers, which, in addition will render necessary the erection of another boiler room, whereas if the remedy first suggested is applied the present machinery will be quite sufficient for several years to come, the meters being a constant guardian of the interests of the city and instantly detecting any extraordinary use or waste of water whether intentional or accidental, and for either of which the owner of the premises should be held strictly accountable. Police supervision will certainly have some effect in reducing the waste of water, and will probably keep the supply within the limits of the capacity of the present pumping machinery, but it cannot be made nearly as effective as meters without the employment of a larger force of patrolmen.

The number of service pipes connected with the mains during the year was 88, of which four were branch connections, four inch diameter, and 84 were by corporation stops one inch or less. The whole number of services connected with the main pipes is 845, of which 21 are by branch castings four inch in diameter and upward, and 824 are by corporation stops,

from three-eighths to two inches in diameter. The fact of the works supplying upwards of two and one-quarter million gallons per day for the entire year, and more than two and one-half million gallons per day for several months through only 845 services, will strike any one familiar with city water supply as being one of the most remarkable cases on record, and is probably without a paralell in this or any other country, and while it should speak volumes for the *cleanliness* of those consumers who do take water, it will hardly be recognized among outsiders as creditable to this city; but the fact that works of the capacity of those in this city have been able to do even a fair fire service, and still supply such a remarkable demand for domestic supply is a credit to the Works which cannot be impeached.

The amount of cash collections made during the year was $13.912.16, an increase over 1879 of $1,968.45. Of this increase $1,891.23 was from water rates. Of these collections $13,603.38 can be properly classed as current receipts, being made up of:

Water Rates	$13,365 14
Rent of Boom	65 00
Sale of Scrap	1 92
Labor on Repairs	27 02
Received for Service Taps in excess of amount paid	118 72
Plumber's Licenses	25 00
	$13,603 38

Amount paid out for current expense account during the year $10,473.69, of which $400 was for salaries and wages for December 1879, not paid until January, 1880, which leave actual operating expenses for the twelve months, $10,073.69, making current receipts in excess of current expenses $3,529.69. The entire amount paid out for all purposes during the year was

$10,798.24. Total receipts in excess of expenditures, $3,113.92.

The balance in the Water Works Fund January 1st, 1880, was - - -	$ 4,810 29	
Adding cash collections deposited with City Treasurer, - - - - -	13,912 16	
	$18,722 45	
And deducting amount withdrawn from Water Works Fund by requisition on the Recorder, - - - - -	$10,800 00	
Leaves a balance in the Water Works Fund of - - - - - - -	$ 7,922 45	
An increase for the year of - -	3,112 16	
The balance in the hands of the Treasurer of the Board, January 1st, 1880, was - -	$328 09	
Adding amount drawn from Water Works Fund and deposited with said Treasurer,	10,800 00	
	$11,128 09	
And deducting amount of orders drawn on said Treasurer during the year, - -	10,798 24	
Leaves balance in hands of Treasurer of Board, - - - - - -	$329 85	

An increase of $1.76.

The following is an itemized statement of the receipts and disbursements of the Board for the year:

RECEIPTS.

From Water Rates, Roll of 1878	$ 23 50	
" " " Roll of 1879	547 40	
" " " Roll of 1880	12,794 24	
		$13,365 14
" Plumber's Licenses,	25 00	
" Rent of Boom	65 00	
" Sale of Scrap Leather	1 90	

From Labor on Repairs	27 62	
" Sale of Service Taps	325 00	
" Sale of Stop Boxes	16 00	
" Sale of Building Stone	10 00	
" Sale of Iron Pipe and Branches	51 75	
" Sale of Valves	24 75	$ 547 02
Total receipts		$13,912 16

These collections have been by months as follows:

January,	$1,583 97	July,	$2,035 56
February,	429 43	August,	398 30
March,	768 00	September,	1,090 33
April,	1,955 28	October,	1,813 66
May,	515 20	November,	713 81
June,	1,137 72	December,	1,470 90
			$13,912 16

This amount has been deposited with the City Treasurer per receipts on file as follows:

1880.	
January 24	$ 1,000 00
" 31	583 97
February 28	429 43
March 31	768 00
April 13	1,000 00
April 24	600 00
April 30	355 28
May 31	515 20
June 30	1,137 72
July 14	1,200 00
July 31	835 56
August 31	398 30
September 30	1,090 33
October 30	1,813 66
November 30	713 81
December 31	1,470 90
	$13,912 16

And by said City Treasurer placed to the credit of the Water Works Fund as required by the Ordinance.

The following amounts have been withdrawn from the Water Works Fund by requisition on the City Recorder as the ordinance requires:

Requisition No.	130,	dated Dec.	31, 1879	$ 750 00
"	" 131,	"	Jan'y 31, 1880	750 00
"	" 132,	"	Feb'y 28,	750 00
"	" 133,	"	March 31,	1,000 00

Requisition No.	134,	dated April	30,	750 00
" "	135,	" May	31,	750 00
" "	136,	" June	30,	1,000 00
" "	137,	" July	31,	750 00
" "	138,	" Aug	31,	900 00
" "	139,	" Sept	30,	750 00
" "	140,	" Oct	30,	750 00
" "	141,	" Nov	30,	1,000 00
" "	142,	" Dec	31,	900 00
Total				$10,800 00

Which has been at once deposited with the Treasurer of the Board as per receipts on file.

DISBURSEMENTS.

The amount expended by the Board as per reports filed monthly has been as follows:

January	$ 707 00	
February	828 66	
March	728 46	
April	955 77	
May	797 00	
June	836 68	
July	689 60	
August	873 33	
September	935 17	
October	749 55	
November	837 03	
December	1,859 99	
Total		$10,798 24

The expenditures have been for the following general accounts:

Office expense and salary account	$ 1,719 12	
Repairs and care of Hydrants, Valves and Pipes	347 43	
Repairs to Engine House	31 91	
Repairs to Dock	13 38	
Repairs to Works at Bay	29 50	
Implements on Repairs and Engineers Tools	49 22	
Total Current Expense, except Pumping		$ 2,190 56
Engineer's and Firemen's Wages	3,601 17	
Fuel account	3,630 62	
Oil, Packing and Engineers Supplies	463 92	
Repairs to Pumping Machinery	207 31	
Repairs to Boiler Arches	380 11	
Total Pumping Expenses		$ 8,283 13
Total Current Expenses		$10,473 69

Service Tap account	206 28	
Service Stop Box account	18 25	
		224 53
Pumping Machinery	57 59	
Laying Pipe	3 60	
Valve account	25 00	
Iron Pipe and Branch Castings	13 83	100 02
		$10,798 24

The items of these expenditures have been as follows:

Office expense and salary account:

Sup't and Sec'ys salary, Dec. 1, 1879, to Dec 31, 1880, 13 months	$1,625 00
Examining Secretary's books for 1879	28 50
Books, Stationary, Ink, etc	35 10
Printing Superintendent's Report for 1879	19 00
Register in Office	3 42
Cleaning Office and carrying up coal	4 50
Discount on Drafts	3 62
	$1,719 12

Engineer's and Firemen's wages:

First Engineer's salary December 1, 1879, to Dec. 31, 1880, 13 months	$1,300 00
Second " " " " " " " " " 13 months	975 00
Two Firemen, " " " " " " " " 13 months	1,300 00
Extra Firemen	26 17
	$3,601 17

Fuel account:

Paid Rouse Bros. for 60 cords slabs, @ 75 cents	$ 450 00
Paid Rouse Bros. for 502⅝ cords slabs, @ 97½ cents	490 05
Paid for delivering above	402 90
Paid Dolsen, Chapin & Co., for 1047 cords slabs, at 75 cents	785 25
Paid for delivering the same	236 25
Paid Dolsen, Chapin & Co., for 260 cords slabs, @ 70 cents	182 00
Paid for delivering the same	65 00
Paid R. J. Briscoe for 400 cords slabs, @ $1 25	500 00
Paid for 153 tons and 1,700 lbs coal	519 17
	$3,630 62

Oil, Packing and Engineer's Supplies:

99½ gallons Cylinder Oil	$ 77 30
10 " Valveoleum Oil	7 00
98 " Lard Oil	65 91
257 " W. Va.	56 61
205½ " Kerosene Oil	38 79
15⅛ lb Tallow	1 14
10 lb Italian Hemp Packing	4 00
13¼ lb Heston Packing	19 87

32 lb Square Rubber Packing	21 31
123¼ lb Sheet Rubber Packing	6 27
Rope for Packing Air Pump	37
Express charges, Freight and Cartage on Oil and Packing	5 65
1441 lb Hemlock Extract	57 64
12 lb Red, White, and Black Lead, and Boiled Oil	2 16
1 Gallon Esphaltum	1 25
825 lb Wipers, @ 7 cents	57 75
10 lb Tripoli, $1 00; Emery cloth, 60 cents; Concentrated Lye, $4 65	6 25
Boiler Compound, $1 80; Pails, $1 00	2 80
Chimnies, Wicks, Matches, etc	5 60
Ice for Engine House, (two seasons)	26 25
	$ 463 92

Repairs to Pumping Machinery:

Repairing Pony Pump	$ 4 10
Holly Manuf'g Co., for Brasses, Springs and Discharge Valves main engine,	25 61
Leather and Labor putting new Valves in Pumps	20 22
Repair to Air Pump	5 40
Repairs to Oil Cups, Whistle, Etc	9 22
Repairs to Piston of High Pressure Engine	10 52
Grate Bars	91 64
Gas Pipe, Valves, Gauge Glass, Try-Cocks, Etc	36 30
Freight, Cartage, Etc	4 30
	$207 31

Repairs to Boiler Arches:

3,100 Fire Brick	$ 91 00
10 bbls Fire Clay	26 25
2,000 Common Brick	16 00
60 Bushels Lime	18 00
Sand and Teaming	28 05
Labor	200 81
	$380 11

Repairs to Engine House :

Repairing Floor	$ 4 40
Repairing Brick work	4 00
Repairing Windows	23 51
	$31 91

Repairs to Breakwater at Bay :

Painting Warning Signs	$ 5 00
Labor Redriving Planking	24 50
	$29 50

Repairs to Dock :

Labor Putting down Plank	$ 2 00
Plank	11 38
	$13 38

Repairs and care of Hydrants, Valves and Pipes:

Labor on Repairs	$305 01
Valve Covers	3 45
Pipe and Sleeves	21 54
Machine Shop Work on Hydrants and Valves	12 83
	$347 43

Implement Account:

Repairing Wrecking Pump and Cartage	$31 24
Repairing Tools at Engine House	2 25
New Tools, Shovels, Axe, &c	4 85
Furnace Hoe, Scraper, &c	3 25
Oil Can, Lanterns, Wrenches, &c	7 63
	$49 22

Service Tap Account:

New Corporation Stops and Freight	$135 53
Labor Inserting Service Taps	70 75
	$206 28

Service Stop Boxes:

One dozen Cast Iron extension Boxes	$18 00
Cartage	25
	$18 25

Pumping Machinery:

Paint and Painting Engine put in in 1879-80	$18 57
Bay City Iron Company, Throttle Lever, New Engine	16 74
Galvanized Iron Covers for Gears	13 00
Exhaust Pipe, Gas Pipe, Bolts, &c., New Engine	8 68
	$57 50

Laying Pipe:

Labor done in 1879 on Laying Pipe	$3 00

Valves:

Four inch Valve for Eddy, Avery & Eddy	$14 00
Three inch Valve for James Shearer	10 50
Freight	50
	$25 00

Iron Pipe:

Branch for Eddy, Avery & Eddy	$4 83
Branch for Shearer	9 00
	$13 83

The quantity of water pumped during the year was 827,067,372 gallons, of which 812,826,332 gallons were pumped at the ordinary domestic pressure of 40 lb per square inch at the level of the pressure gauge, which

is equivalent to a lift of 107 feet from the level of the water in the wells, and 14,241,040 gallons were pumped at an average fire pressure of 90 lb per square inch at the gauge, equal to a lift of 223 feet.

The following statements show the quantity and value of material used during the year in running the pumping engines.

There was on hand January 1, 1880:

40 cords of Slabs	costing	$ 40 00	
15 gallons of Lard Oil	"	8 25	
2 gallons of Valveoleum	"	1 60	
28 lb Rubber Valves and Packing	"	20 10	
30 lb Piston Packing	"	15 30	
470 lb Hemlock Extract	"	18 80	
19 gallons Kerosene Oil	"	3 70	
21 Lamp Chimnies	"	1 75	
10 lb Wiping Rags	"	70	
Tripoli and Rotten stone	"	1 30	
Brooms	"	83	
Emery and Emery Cloth	"	1 55	
			$113 88

There has been delivered at Works during the year:

2,829¼ cords of Slabs and Edgings	costing	$ 3,111 45	
153 tons and 1,700 lb of Coal	"	519 17	
99½ gallons Cylinder Oil	"	77 30	
10 " Valveoleum	"	7 00	
98 " Lard Oil	"	65 91	
257 " W. Va. Oil	"	56 61	
15¼ lb Tallow	"	1 14	
10 lb Hemp Packing	"	4 00	
13¼ lb Heston Packing	"	19 87	
32 lb Square Rubber Packing	"	21 31	
12¾ lb Sheet Rubber	"	6 27	
Rope Packing for Air Pump	"	37	
Express Charges, Freight and Cartage	"	5 65	
825 lb Wipers	"	57 75	
1441 lb Hemlock Extract	"	57 64	
Red Lead, White Lead, Black Lead and Oil	"	2 16	
Asphaltum	"	1 25	
205½ gallons Kerosene Oil	"	38 79	
Chimnies, Wicks and Matches	"	5 60	
10 lb Tripoli	"	1 00	
Emery, Boiler Compound and Concentrated Lye	"	8 05	
Ice for Engine House	"	15 00	
Ice for season of 1879, not paid for until this year	"	11 25	
			$4,094 54
Making total to be accounted for			$4,208 42

There has been used during the year:

2,819⅝ cords of Slabs	costing	$3,113 95	
153 tons and 1,700 lb of coal	"	519 17	
99⅛ gallons Cylinder Oil	"	77 30	
2 " Valveoleum	"	1 60	
95 " Lard Oil	"	61 92	
222 " W. Va. Oil	"	49 61	
15½ lb Tallow	"	1 14	
30⅛ lb Hemp and Cotton Packing	"	14 65	
7¼ lb Heston Packing	"	10 87	
23¼ lb Rubber Packing and Sheet Rubber	"	15 43	
Rope Packing	"	37	
Express, Freight and Cartage	"	5 65	
835 lb Wipers	"	58 45	
1430 lb Hemlock Extract	"	57 20	
Red Lead, &c	"	3 41	
224⅛ gallons Kerosene Oil	"	42 49	
Chimnies, Wicks, Matches, &c	"	5 13	
Tripoli and Rotten Stone	"	2 30	
Emery, Concentrated Lye, Boiler Compound, &c	"	7 93	
Ice, (1879 and 1880)	"	26 25	
Total used			$4,074 82

There is on hand December 31, 1880:

3.- cords slabs	costing	$ 37 50	
10 gallons Valveoleum	"	7 00	
18 " Lard Oil	"	12 24	
35 " W. Va. Oil	"	7 00	
9½ lb Hemp and Cotton Packing	"	4 65	
6 lb Heston Packing	"	9 00	
38 lb Rubber Packing	"	26 60	
11⅛ lb Sheet Rubber	"	5 65	
481 lb Hemlock Extract	"	19 24	
Chimnies, Wicks and Wicking	"	2 22	
Emery Cloth and Concentrated Lye	"	2 50	
Total on Hand			$ 133 60
Total accounted for			$4,208 42

Taking value of material consumed as above:

Fuel	$3,633 12	
Oil, Packing, &c	441 70	
Engineer's and Firemen's wages, for 12 months	3,320 17	
Repairs to Pumping Machinery	207 31	
Repairs to Boiler Arches	38 11	
Makes total cost of Pumping		$7,388 41
Cost per million gallons pumped	$ 9 66	
" " " " raised 100 feet	8 86	
Cost of Fuel per million gallons pumped	4 39	
" " " " " raised 100 feet	4 03	

Taking whole amount paid for current expenses during the year ... $10,473 69

The cost per million gallons pumped is $12 66
" " " " raised 100 feet 11 02

The following table shows by months, the quantity of water pumped during the year; number hours run by high pressure engine and rotary pumps; number hours run for fire and number of fire alarms:

Month.	No. gals. pumped by main piston engines and pumps.	No gals. pumped by high pressure engine and rotary pumps.	No. gals. pumped at fire pressure.	Total gallons pumped.	Hours run by H. P. engine.	Hours run for fire.	No. fire alarms
January	55,815,832	916,000	62,000	56,793,832	12	30	1
February	55,120,000	360,000	3,357,720	58,837,720	4	24	5
March	54,132,000	640,000	1,284,420	56,056,420	9	9	8
April	58,812,000	128,000	630,000	59,570,000	1½	4 30	11
May	70,772,200	554,000	1,140,000	72,466,000	5	6 20	3
June	68,328,000	780,000	180,000	69,288,000	7	30	1
July	74,542,000	1,008,000	407,200	75,957,200	9	2	6
August	76,882,052	550,000	358,800	77,790,852	5	2 30	3
September	73,502,988	.....	1,944,090	75,447,078	....	9 30	3
October	74,098,960	702,090	1,488,800	76,289,850	7	7	3
November	74,908,860	300,660	2,307,800	77,517,320	3	13 20	8
December	69,041,780	331,110	1,080,210	71,053,100	3	6 30	5
Totals	806,556,472	6,269,860	14,241,040	827,067,372	65¾	85 40	57

The regular Assessment Roll for 1881 amounts to $10,500, not including the supply to boilers in saw mills. Should the supply to the mills be discontinued, the receipts from Water Rates will probably amount to about $11,000. Should the supply to mills be continued at present rates, the additional $3,000 to be received from them will be dearly earned.

The regular Roll for 1881 embraces the following uses of water:

414 Dwellings.
85 Families in blocks.
136 Lawn Hose.
89 Private baths.
260 Water closets.
62 Private stables.
5 Bakeries.
3 Banks.
4 Halls and lodges.
1 Jail.
1 Library.
10 Livery stables.
5 Machine shops.
12 Mill stables.
4 Mills, planing.
1 Mill, flouring.

8 Barber Shops.
3 Bath Houses.
4 Blacksmith shops.
24 Boarding houses.
5 Bottling works.
16 Butcher shops.
1 Brewery.
1 Church.
1 Court house.
1 Cracker factory.
1 Gas works.
3 Harness shops.
1 Hospital.
22 Hotels.
1 Hydraulic elevator.
2 Passenger depots.
4 Photograph galleries.
3 Printing offices.
8 Restaurants.
2 Root beer works.
1 Round House.
74 Saloons and bars.
1 Salt Crusher.
5 School buildings.
1 Spoke factory.
64 Stores.
1 Street car barn.
1 Steam laundry.
1 Telegraph Office.
1 Water motor.

Water has been supplied during the past season for the following uses, not included in the above, the consumers paying only for the time the water was used, and assessed by the month:

7 Drill houses.
7 Saw mills.
5 Salt blocks.
6 Saw mills, for cleaning boilers only.
1 Pipe works.
3 Ornamental fountains.

Water is supplied for the following uses for which no assessment is made:

1 R. R. Co., for locomotive and shop use.
1 City building, police station and city offices.
3 City Hose Houses.
11 Public drinking fountains.
2 Ornamental fountains in public square.
138 Public fire hydrants kept in repair and working order at the expense of the water works.

The supply from 10 service taps has been discontinued, and new services put in in place of them, and 15

services are shut off by reason of buildings having been burned or removed and not re-built.

61 services are shut off for non-payment of water rates or by request, as follows:

9 Vacant buildings.	3 Stores.
4 Dwellings not completed	4 Shops & manufacturies.
23 Occupied dwellings.	1 Church.
10 Lawn hose.	3 Pasture lots.
3 Private stables.	1 Block of stores.

The following table shows amount collected, and total of Water Rates Roll each year since the works started:

Years.	Amount Collected.	Amount Uncollected.	Total of Roll.
1873, January 1st to April 30th	$ 728 82		$ 728 82
1873-4, May 1st to April 30th	5,440 80	$ 1 60	5,442 40
1874-5, May 1st to April 30th	6,908 16	44 85	6,953 01
1875, May 1st to Dec. 31st	7,269 55	28 46	7,298 01
1876	9,571 26	82 73	9,653 99
1877	9,599 26	139 19	9,738 45
1878	10,065 90	336 90	10,402 80
1879	11,695 19	149 85	11,845 04
1880	12,794 24	486 75	13,280 99
Totals	$74,073 18	$1,270 39	$75,343 57

The following table shows number and size of service taps connected with the mains during the year:

	½ inch.	⅝ inch.	¾ inch.	1 inch.	Total.
With Iron Mains	4	2	4	3	13
With Wyckoff Mains	20	2	33	16	71
Totals	24	4	37	19	84

Total services connected with mains to date:

	⅜ inch.	½ inch.	⅝ inch.	¾ inch.	1 inch.	1¼ in.	2 in.	Total
With Iron Main	5	57	22	40	37	6	2	169
With Wyckoff Main		248	2	295	73		13	631
	5	305	24	335	110	6	15	800

Of these, one 2-inch connected with Wyckoff pipe.
One 1-inch " " " "
One 1¼-inch connected with Iron pipe.
One 1-inch " " "

are for waste pipes into sewers, and have no services connected with them.

In addition to the service connections above described, there are branch pipes leading into private property, as follows:

One 8-inch.
Four 6-inch.
One 5-inch.
Twelve 4-inch.
Three 3-inch.

And in the pipes laid from these branches are connected smaller services, as follows:

Four ½-inch.
Three ¾-inch.
Eight 1-inch.
Nine 2-inch.

Making whole number of service attachments, besides branches, 824.

The following balance-sheet shows the Ledger balance at the close of the year 1880:

As will be seen from this balance-sheet the total Dr. balances on construction account, are $365,658.58, leaving a balance still available for construction, of $2,387.29.

There have been a number of applications during the past year for extensions of the main pipes which will no doubt be renewed next Spring. Some of these it will be unjust to neglect further. In addition to the pipe which should be laid in the city, there should be some work done on the reservoir at the bay. The planking driven four years ago to protect the inner slope of the Reservoir is beginning to give way; these

slopes should be permanently protected by paving from low water to high water mark. This work will, if done, leave but a small amount of money applicable to other branches of construction and before much work can be done towards enlarging or extending the works, it will be necessary for the City Council to provide more funds or take such action as will authorize the use of the balance now in the Water Works Fund for this purpose.

The streets where consumers are most urgent about having pipes laid at once are located in Seymour's addition, north of Woodside Avenue, and south of Tenth street east of Adams. A great deal depends upon whether the mills along the river are to be supplied with water during the coming season in deciding where pipes should be located. If the supply to the mills is to be continued, it will be necessary to lay the pipes, such as are laid, where they will best reinforce the supply to the southern part of the city without much reference to the accomodation of consumers.

Ledger balances, December 31, 1880:

DR. BALANCES.

Real Estate	Folio	475	$ 6,724 83
Dock, Tramway and Store Shed	"	475	1,882 63
Engine House, Chimney and Wells	"	476	19,097 42
Engine Foundations, Boiler Foundations and Arches	"	476	4,931 72
Inlet from River	"	477	3,218 99
Inlet from Bay	"	477	84,778 37
Reservoir, and Breakwaters at Bay	"	478	21,491 78
Filter at Bay	"	478	1,683 13
Pumping Machinery	"	479	39,015 02
Iron Pipe and Branch Castings	"	479	52,709 03
Wyckoff Patent Pipe	"	480	67,683 68
Laying Iron Pipe	"	480	14,462 42
Laying Wyckoff Pipe	"	481	17,428 35
Valves for Street Mains	"	481	8,545 06
Public Fire Hydrants	"	482	7,274 99
Furniture and Fixtures	"	485	621 92

Implements used on Construction	Folio	482	1,713 61	
Interest, Discounts and Commissions on construction	"	484	4,224 17	
Insurance on Construction	"	484	29 00	
Engineering and General Superintendance on con	"	483	7,856 17	
Traveling Expenses on Construction	"	483	306 29	
				$365,658 56
Water Meters	Folio	487	$ 71 48	
Service Stop Boxes	"	487	15 45	
				$86 93
Water Works Fund	"	505	7,922 45	
Orrin Bump, Treasurer of Board	"	508	329 85	
				$8,252 30
Rorison & McKinney	"	519	19 40	
Thomas Rosa	"	519	15 57	
A. L. Stewart	"	520	15 00	
Campbell & Church	"	520	4 00	
				$53 97
Office Expense and Salary Account	"	510	13,550 56	
Engineers and Firemens Wages	"	511	27,992 84	
Fuel Account	"	550	18,997 81	
Oil, Packing and Engineers Supplies	"	550	3,175 95	
Repairs to Pumping Machinery	"	514	1,426 89	
Repairs to Boiler Arches	"	515	502 68	
Repairs to Engine House and Insurance	"	515	305 12	
Repairs to Dock	"	518	13 38	
Repairs and Care of Hydrants, Valves and Pipes	"	517	3,814 98	
Repairs to Reservoir and Breakwaters	"	516	84 50	
Implement account on Repairs	"	516	501 24	
				$ 70,305 05
Total Dr Balances				$444,417 73

LEDGER BALANCES, CR.

Bay City Bond account ($377,000 bonds,)	Folio	474		$368,645 87
Water Assessment, front on pipe	"	474		736 07
Service Tap Account	"	488		691 83
Plumbers Licenses	"	490		163 45
Rents, Dockage, &c	"	490		707 33
Water Rates—Roll of 1872-3	"	491	$ 728 82	
" " Roll of 1873-4	"	491	5,440 80	
" " Roll of 1874-5	"	491	6,908 16	
" " Roll of 1875	"	491	7,269 55	
" " Roll of 1876	"	491	9,571 26	
" " Roll of 1877	"	491	9,599 26	
" " Roll of 1878	"	491	10,065 90	
" " Roll of 1879	"	492	11,695 10	
" " Roll of 1880	"	495	12,794 24	
				$ 74,073 18
Total Cr. Balances				$444,417 73

The usual yearly examination of the books of this office was made in March last; the report of the accountants is appended to this report. This examination should be made every year, and the City Council at their next meeting will be requested to appoint a committee for the purpose.

Respectfully submitted,

E. L. DUNBAR,

Secretary and Superintendent.

Bay City, January 11th, 1881.

REPORT OF ACCOUNTANTS.

To the Honorable Board of Water Commissioners of the City of Bay City:

GENTLEMEN:—We, the undersigned accountants, employed to examine the books and accounts of the Bay City Water Works for the year 1879, would respectfully report as follows:

That we have carefully examined the records, vouchers, accounts and books of the Secretary, and find them correct in every particular.

The ledger balances for December 31st, 1879, as shown in the report of the Superintendent for the year 1879, and dated January 13th, 1880, are correct.

We have also examined particularly all assessment rolls and compared the same with the stubs of receipts and find they agree perfectly with the daily record of receipts and day book, and the cash and book accounts as shown by the books of the Secretary on the 1st day of January, 1880.

(Signed,) D. A. MARSHALL,
C. F. BRAMAN,
Accountants.

Bay City, March 22d, 1880.

TENTH

ANNUAL REPORT

OF THE

SUPERINTENDENT OF

WATER WORKS

TO THE

Board of Water Commissioners

OF

BAY CITY, MICH.,

FOR 1881.

Jas. Gray, Printer, Bay City.



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OF

BAY CITY, MICH.,

FOR 1881.

BAY CITY, MICH.:
JAS. GRAY, PRINTER AND STATIONER.
1882.

Members of the Board of Water Works.

JANUARY 1st, 1882.

President, WM. WESTOVER.

First Ward, - -	ANDREW WALTON.
Second Ward, - -	THOMAS CRANAGE, JR.
Third Ward, - -	WM. WESTOVER.
Fourth Ward, - -	WM. SMALLEY.
Fifth Ward, - -	CHAS. E. YOUNG.
Sixth Ward, - -	DUNCAN MCGREGOR.
Seventh Ward, - -	GEO. C. MEYERS.

Superintendent and Secretary, -	E. L. DUNBAR.
First Engineer, - -	A. B. VERITY.
Second Engineer, - - -	FRED. H. HOLLY.

LIST OF MEMBERS OF THE

BOARD OF WATER WORKS

FROM DATE OF ORGANIZATION.

FIRST WARD.

MICHAEL DAILY, appointed Sept. 6th, 1871; resigned May 13th, 1872.
ANDREW WALTON, appointed May 27th, 1872.
ANDREW WALTON, re-appointed Dec. 9th, 1872.
ANDREW WALTON, re-appointed Feb. 4, 1878; term expires Sept. 6, '82

SECOND WARD.

JAMES SHEARER, appointed Sept. 6, 1871; term expired Sept. 6, 1873.
THOMAS CRANAGE, Jr., appointed Nov. 3, 1873.
THOMAS CRANAGE, Jr., re-appointed Sept. 2, 1878; term expires Sept. 6, 1883.

THIRD WARD.

WILLIAM WESTOVER, appointed Sept. 6, 1871.
WM. WESTOVER, re-appointed March 29, 1875.
WM. WESTOVER, re-appointed Oct. 20, 1879; term expires Sept. 6, 1884.

FOURTH WARD.

JOHN McDOWELL, appointed Sept. 6th, 1871; died May 11, 1872.
WM. SMALLEY, appointed May 27, 1872.
WM. SMALLEY, re-appointed Feb. 4, 1878.
WM. SMALLEY, re-appointed Dec. 13, 1880; term expires Sept. 6, 1885.

FIFTH WARD.

HENRY M. BRADLEY, appointed Sept. 6, 1871.
HENRY M. BRADLEY, re-appointed Feb. 4, 1878; resigned May 3, 1880.
CHAS. E. YOUNG, appointed June 1, 1880.
CHAS. E. YOUNG, re-appointed Sept. 5, 1881; term expires Sept. 6, 1886

SIXTH WARD.

ANDREW J. MILLER, appointed Aug. 4, 1873; term expired Aug. 4, 1874
JAS. CLARKE, appointed Oct. 13, 1874; term expired Aug. 4, 1879.
WM. DAGLISH, appointed Oct. 20, 1879; resigned Oct. 24, 1881.
DUNCAN McGREGOR, appointed Oct. 31, 1881; term expires Aug. 4, '84.

SEVENTH WARD.

THOS. H. McGRAW, appointed Aug. 4, 1873; resigned Sept. 14, 1874.
W. C. McCLURE, appointed Sept. 21, 1874.
W. C. McCLURE, re-appointed Nov. 8, 1875; resigned March 24, 1879.
GEO. C. MEYERS, appointed May 5, 1879.
GEO. C. MEYERS, re-appointed Dec. 13, 1880; term expires Aug. 4, 1885.

To the Honorable Board of Water Commissioners of Bay City, Michigan:

GENTLEMEN:—In compliance with the Regulations of the Board I have the honor to submit my Tenth Annual Report, the same being for the year ending December 31st, 1881.

There has been no extension of the street mains, or enlargement of the main works in any direction during the year. There has been a fair increase in the number of water consumers and a more than fair increase in the quantity of water pumped. The reckless use of hose for sprinkling lawns, and for wetting down as a precaution against fires in localities exposed to fires during the dry months of July, August and September, taken in connection with the other extravagant wastes of water indulged in by some consumers, seriously impaired the fire protection of the city, and convinced everyone that something must be done at once to either check these extravagant uses of water, or increase the capacity of the works.

The attempt was made to check the useless waste of water by means of a systematic examination of premises where water was used in large quantities, and posting notices calling attention to important sections of the Water Works Ordinance, which it appeared necessary to enforce. This action had some effect in the desired direction, but nothing like what the exigencies of the case required, it being impossible to secure that hearty co-operation from the public and from the police force which is so necessary in an attempt to

check the waste of water in this way. Having demonstrated the insufficiency of this plan to accomplish the desired result, the Board at length decided to try the plan which, in view of just such an emergency as had now arisen, had been earnestly and repeatedly recommended by me for the past four years; that is, of placing meters on all large services where water could be wasted in large quantities in a short space of time. Before this action was taken, however, wet weather had arrived and the immediate danger of having our city destroyed by fire had passed.

As soon as possible after the first installment of meters arrived they were placed in position and had more effect in checking the waste of water on the premises where set, than all of the notifications or police surveillance that could possibly be extended.

Six large meters are now in successful operation and I trust that the Board will not stop in this work until every service pipe in the city larger than one inch in diameter is properly metered. It is an injustice to those metered, to compel *them* to be careful in their uses of water and abstain from the use of hose except when necessary, but leave the way open for their neighbor to waste water as much as he pleases, using large hose for cleaning salt grainers or washing dirt off from timbers, or filling large grainers or settlers with water to see whether they will leak or not, and numerous other uses for which they pay nothing unless the meters, *ever watchful* are attached to their pipes and indicate what amount of water is passing through.

The cost of operating the works has been more than for any previous year; there has been several reasons

for this. The severe winter of 1880-81 rendered necessary an extra amount of labor to keep the fire hydrants in repair and working order. There has also been a larger number of leaks and breaks in our main pipes than for any previous season since 1877. There has been 18 leaks in the Wyckoff Pipe, of which 7 were defective pipe requiring the insertion of new pipe, 3 were knot holes, repaired by plugging, and 8 were leaks in joints repaired by caulking. The cost of these repairs, including labor and material was $164.94. The boilers at the engine house have required patching several times, making the account for repairs to pumping machinery larger than for any previous year; the large increase in the quantity of water pumped increased the fuel account several hundred dollars and rendered it necessary to emyloy an extra fireman at an expense of $120 for the year, to report for duty at the engine house at every fire alarm to assist in getting fuel into the fire room. For the same reason the account for oil and packing has been considerably increased over previous years.

The quantity of water pumped during the year was 944,382,043 gallons; showing an increase over the preceding year of 117,314,671 gallons, or more than 14 per cent. while the amount collected from water rates has increased $1,395.42, or a trifle over 10 per cent. This is only additional evidence that the waste of water contiuues to increase from year to year, and that the measures inaugurated to prevent this waste cannot be carried to completion too soon.

The building up of the southern portion of the city, which is progressing rapidly, calls for action on the part of the Board looking towards a better water supply for that part of the city. While it is believed

that metering the large services will help this supply very materially, should it give that part of the city a supply equal to what it was a few years ago, it will still be inadequate to their requirements.

The 6 inch pipe in Belinda street should be replaced by a 10 inch pipe to Woodside, which pipe should be extended on Johnson street to Center street, an 8 inch pipe should be laid from Tenth street south as far as Eighteenth street, thence a 6 inch pipe should be laid on such streets as will give the most revenue as far as the Bullock road. This work cannot all be done at once with the means at the command of the Board and with only the revenue from water rates to depend upon, but it should be commenced, and whatever pipes are laid should be located with this object in view. The cost of this work completed including the necessary valves and hydrants, will be about $17,500.00.

I again call the attention of the Board to the necessity of protecting the inner slopes of the reservoir at the bay by paving. The reservoir needs cleaning out, and when pumped out should be timbered below low water mark and paved from low water to high water mark. It is impossible to make a close estimate of the cost of this work as it cannot be determined how much material will have to be taken out of the reservoir until it is pumped out, but I think the cost will be less than $3,000.00.

It will soon be necessary to procure new pumps for the main pumping engines. The Holly Company estimate the cost of these pumps at $4,750.00, free on board cars at Lockport; it will probably be necessary to procure them next winter, but it may be possible

to run the old ones longer if no accident happens them.

The following statements show in detail the operation of the works during the year.

The total amount of cash collections during the year, was $15,360.11 an increase of $1,447.75 over 1880. Of this increase $1,395.42 was from water rates. Of these collections $15,111.08 may be classed as current receipts, being made up of:

Water Rates,	$14,760.56
Rent of Boom,	65 00
Sale of Scrap	3 30
Labor on Repairs for private parties,	23 75
Plumber's Licenses,	25 00
Received for Service Taps in excess of amount paid,	233 47
	$15,111,08

The amount paid out for current expense account during the year was $11,030.37, all of which was for actual operating expenses for the twelve months and shows an increase of $956.68 over the preceding year. The current receipts have however exceeded the current expenses by $4,080.71, showing a net gain over 1880 of $551.02. The total amount paid out for all purposes during the year was $12,973.39. Total receipts in excess of expenditures, $2,386.72.

The balance in the Water Works Fund January 1st, 1881, was	$ 7,922 45
Adding cash collections deposited with the City Treasurer,	15,360 11
	$23,282 56
And deducting amount withdrawn from Water Works Fund by requisition on the City Recorder,	$13,000 00

Leaves a balance in the Water Works Fund Dec. 31st, 1881,	$10,282 56
An increase for the year, of	2,360 11
The balance in the hands of the Treasurer of the Board, January 1st, 1881, was	329 85
Adding amount drawn from Water Works Fund and deposited with said Treasurer,	13,000 00
	$13,329 85
And deducting amount of orders drawn on the Treasurer during the year,	12,973 39
Leaves balance in hands of Treasurer of Board, December 31st,	$356 46

An increase for the year, of $26.61.

This balance is predicated on all orders drawn having been presented for payment.

The following is an itemized statement of the receipts and disbursements of the Board for the year:

RECEIPTS.

From Water Rates, Roll of 1878,	$ 3 50		
" " Roll of 1879,	4 41		
" " Roll of 1880,	227 64		
" " Roll of 1881,	14,525 01		
			$14,760 56
From Plumber's Licenses,	$ 25 00		
" Rent of Boom,	65 00		
" Sale of Old Material and Scrap,	3 30		
" Labor on Repairs for private parties,	23 75		
" Sale of Service Taps,	461 00		
" Sale Stop Boxes,	14 70		
" Sale of Iron Pipe,	6 80	$ 599 55	
Total Receipts,			$15,360 11

These collections have been by months as follows:

January,	$1,349 25	July,	$2,013 68
February,	442 10	August,	369 18
March,	945 44	September,	1,787 57

April,	1,898 28	October,	2,080 20
May,	378 74	November,	571 85
June,	1,632 82	December,	1,891 00
			$15,360 11

This amount has been deposited with the City Treasurer as per receipts on file as follows:

January 26,	$ 800 00	July 30,	$2,013 68
January 31,	549 25	August 31,	369 18
February 28,	442 10	September 30,	1,787 57
March 31,	945 44	October 15,	1,200 00
April 14,	1,000 00	October 31st,	880 20
April 30,	898 28	November 30,	571 85
May 31,	378 74	December 21,	1,000 00
June 30,	1,632 82	December 31,	891 00
			$15,360 11

To be placed to the credit of the Water Works Fund.

The amounts withdrawn from the Water Works Fund by requisition on the Recorder as required by Ordinance, have been as follows:

Requisition No.	143,	dated	January	31,	1881,	$ 1,000 00
" "	144,	"	February	28,	"	1,000 00
" "	145,	"	March	31,	"	1,000 00
" "	146,	"	April	30,	"	900 00
" "	147,	"	May	31,	"	800 00
" "	148,	"	June	30,	"	900 00
" "	149,	"	July	29,	"	900 00
" "	150,	"	August	30,	"	900 00
" "	151,	"	Sept'r	30,	"	1,000 00
" "	152,	"	October	31,	"	1,000 00
" "	153,	"	Novem.	30,	"	2,000 00
" "	154,	"	Decem.	30,	"	1,600 00
Total,						$13,000 00

Which amounts have been at once deposited with the Treasurer of the Board as per receipts on file.

DISBURSEMENTS.

The amount expended by the Board as per reports submitted to the City Council each month, has been as follows:

January,	$ 614 79	July,	$ 804 16
February,	983 48	August,	898 28
March,	1,055 86	September,	827 31
April,	953 51	October,	994 25

May,	940 60	November,	2,167 21
June,	909 88	December,	1,824 06

Total Disbursements, $12,973 39

These expenditures have been for the following general accounts:

Office expenses and Supt. and Sec. salary,	$1,677 22	
Repairs and care of Hydrants, Valves and Pipes,	882 76	
Repairs to Engine House,	115 57	
Implements on Repairs and Repairing Tools,	78 22	
Total for Current Expenses, except Pumping,		$ 2,753 77
Engineer's and Firemen's Wages,	3,480 00	
Fuel Account,	3,943 42	
Oil, Packing and Engineer's Supplies,	524 24	
Repairs to Pumping Machinery,	320 44	
Repairs to Boiler Arches,	8 50	
Total Pumping Expenses,		$ 8,276 60
Total for Current Expenses,		$11,030 37
Service Tap account,	$ 227 53	
Water Meter account,	1,564 68	
Pumping Machinery,	94 62	
Valves,	39 45	
Iron Pipe and Branch Castings,	16 74	$1,943 02
		$12,973 39

The items of these expenditures have been as follows:

Office expenses and Supt. and Sec. salary:

For Superintendent and Secretary's salary, one year,	$1,500 00
Repairs to Office and to Office Furniture,	6 15
Coal for office,	21 85
Exchange on Drafts,	3 35
Account, Record and Memorandum books,	5 10
Assessment Roll,	21 50
Receipt Books,	26 00
Blank Permits and returns,	14 25
Blank Notices and Publishing Cards and Notices,	15 10
Ink and Stationery,	12 17
Accountant's examining Secretary's books, 1880,	32 75
Printing Superintendent's Report for 1880,	19 00
	$1,677 22

Repairs and care of Hydrants, Valves and Pipes:

For Labor on Repairs,	$ 664 44
Posting Notices and extra police duty,	20 10
Drayage and Teaming,	13 60
Machine shop work on repairing Hydrants and Valves,	21 79
Sleeves and Pipes for repairing breaks,	61 69
Repairing Service pipes broken by sewer contractors,	7 14

For Wooden Valve Cases,		$ 8 10
Iron Valve Boxes,		45 00
Valve Case covers,		22 95
Piers under pipe at Union block,		14 00
Scrap Lead, Nails, Salt, &c.,		3 95
		$ 882 76

Repairs to Engine House:

For Ventilator on roof of boiler house,		$ 54 23
Floor in boiler house,		39 67
Repairing roof, valleys, &c.,		21 67
		$ 115 57

Implement Account:

For New Tools for street work,		$ 4 60
Repairing old tools,		12 19
New slab car and trucks,		35 58
Hose and small tools for engine house,		25 85
		$ 78 22

Engineer's and Firemen's Wages:

For First Engineer's salary, one year,		$1,200 00
Second Engineer's " "		900 00
Two Firemen, one year,		1,260 00
One extra fireman for duty during fires,		120 00
		$3,480 00

Fuel Account:

Paid R. J. Briscoe for 771 cords slabs, delivered,		$ 963 75
" " 72 " "		72 00
Rouse Bros., for 1357½ "		1,018 12
Dolsen, Chapin & Co., for 746 cords slabs,		522 20
" " " 443 "		376 55
" " " 228 "		171 00
For hauling 1,357½ cords slabs from Rouse's,		489 30
" " 1,251 " " D. C. & Co's		312 75
" " and moving 166 cords D. C. & Co's slabs,		17 75
		$3,943 42

Oil and Packing Account:

For 29 gallons Valveoleum,		$ 32 96
50 " Ex. Cylinder Oil,		46 25
206½ gallons Mecca Cylinder Oil,		154 89
100 " Mecca Oil,		45 00
58 " West Virginia Oil,		14 54
309 " Kerosene Oil,		49 93
3 lb Manhattan Packing,		2 00
8⅜ lb Heston Packing and Express,		13 06
17 lb Square Rubber Packing,		8 91
3 Air Pump Valves and express,		16 01

For Rubber Gaskets 10¼ lb and express,	$ 6 05
20 lb Hemp Packing,	5 00
18 lb Cotton Packing,	6 55
Tarred Rope, for Air Pump,	72
76¾ lb Sole Leather,	24 98
1¾ lb Upper Leather,	1 50
947 lb Wipers,	65 81
23 lb Red and White Lead,	2 51
1 gallon Boiled Oil,	75
Packing Paper and Wire,	73
5 lb Wicking,	2 00
2 gallons Asphaltum,	3 00
1 case Matches,	5 00
10 lb Tripoli,	1 00
Emery Cloth,	09
Ice for season 1881,	15 00
	$ 524 24

Repairs to Pumping Machinery :

For patching and repairing boilers,	$210 37
Gauge glasses, gauge cocks, &c,	6 90
Liners for fire doors,	4 96
Repairs to feed pumps,	42 14
Gas pipe and fittings,	7 42
Extra work on re-valveing pumps,	7 50
Braces and Plates for pumps,	12 89
Bolts, Rivets, &c., "	7 97
New pin and fitting brasses, (main engine,)	14 07
Cover for steam gauge,	40
Springs for pistons,	5 82
	$ 320 44

Repairs to Boiler Arches :

For Labor completing rebuilding Arches, nearly finished Dec. 1880, $ 8 50

Service Tap Account :

For 11¼ dozen new Corporation Stops,	$122 60
Re-threading new " "	5 77
Labor, screws, &c., tapping mains,	99 16
	$ 227 53

Water Meter Account :

For 14 Water Meter, 1 in. to 4 in. supply,	$1,408 00
Freight on same,	15 19
Connections, bolts, pipes, &c., for setting,	41 53
Labor setting meters,	63 49
Cartage on meters and boxes,	4 80
Boxing meters,	31 67
	$1,564 68

Pumping Machinery :

For exhaust pipe from high pressure engine to chimney, putting up same and posts for supporting pipe, - - -	$ 94 62

Valve Account :

For two 4 in. and one 3 in. Valve, - - - -	$ 38 00
Freight and telegraphing, - - - -	1 45
	$ 39 45

Iron Pipe and Branch Castings :

For three 4x4 tees, - - - - -	$ 16 74

The quantity water pumped during the year was 944,382,043 gallons, of which 930,797,053 were pumped at a pressure of 40 lb. per square inch at the level of the pressure gauge, which is equivalent to a lift of 107 feet from the surface of the water in the wells; and 13,584,990 gallons were pumped against an average fire pressure of 90 lb. per square inch at the gauge, which is equal to a lift of 223 feet from the surface of the water in the wells.

The following statements show the quantity and value of material used in running the pumping engines during the year :

There was on hand Jan. 1st, 1881 :

30 cords slabs, - - - - - -	$ 37 50
10 gallons valveoleum, - - - -	7 00
18 gallons lard oil, - - - - -	12 24
35 gallons West Virginia oil, - - -	7 00
9½ lb hemp and cotton packing, - - -	4 65
6 lb Heston packing, - - - -	9 00
38 lb rubber packing, - - - - -	26 60
11½ lb sheet rubber, - - - - -	5 65
481 lb hemlock extract, - - - -	19 24
Lamp chimnies, wicks and wicking, - - -	2 22
Emery, emery cloth, concentrated lye, &c., - -	2 50
	$ 133 60

The has been delivered at the works during the year :

3,617½ cords of slabs and edgings, - - -	$3,943 42
29 gallons of valveoleum, - - - -	32 96
50 " ex. cylinder oil, - - - -	46 25
206½ " Mecca cylinder oil, - - -	154 89

100 gallons mecca oil,	$ 45 00	
58 " West Virginia oil,	14 54	
8⅜ lb of Heston packing,	13 06	
17 " square rubber packing,	8 91	
3 air pump valves,	16 01	
10¼ lb rubber gaskets,	6 05	
20 " hemp packing,	5 00	
18 " cotton packing,	6 55	
Tarred rope, packing paper and wire for joint,	1 45	
78½ lb leather for pump valves and pumps,	26 48	
23 " red and white lead, and 1 gallon boiled oil,	3 26	
309 gallons kerosene oil,	49 93	
6 dozen lamp chimneys, wicks and wicking,	9 40	
One case matches,	5 00	
947 lbs wipers,	65 81	
30 " tripoli and 5 lbs rotten stone,	3 50	
Emery cloth, asphaltum, &c.,	3 09	
6 cases concentrated lye,	16 50	
Ice for season of 1881,	15 00	
		$4,492 06
Total to be accounted for,		$4,625 66

There is on hand at the Engine House Dec. 31st, 1881:

66 cords of slabs, (paid for,)	$ 66 00	
93 gallons Mecca oil,	41 85	
13 lbs. rubber, air pump valves,	16 01	
5 " Heston packing,	7 50	
30 " rubber packing and sheet rubber,	15 00	
2 " gaskets,	1 10	
6½ " hemp packing,	1 62	
12 " cotton packing,	4 20	
7 " leather,	2 24	
8 " red and white lead,	80	
30 gallons kerosene oil,	3 60	
Lamp chimnies, wicks, and wicking,	6 11	
Matches,	4 17	
130 lbs. wipers,	9 10	
13 " tripoli and rotten stone,	1 30	
		$ 180 60

There has been used during the year:

3,581½ cords of slabs and edgings,	$3,914 92
10 gallons valveoleum,	7 00
18 " lard oil,	12 24
29 " valveolene,	32 96
50 " ex. cylinder oil,	46 25
206½ " Mecca oil,	154 89
7 " Mecca cylinder oil,	3 15
93 " West Virgina oil,	21 54
9⅜ lbs. Heston packing,	14 56
41¼ lbs rubber valves, gaskets and packing,	31 11

29 lbs. hemp and cotton packing,	$ 10 38	
Rope, paper and wire for packing,	1 45	
71½ lbs. leather,	24 24	
15 lbs. red and white lead, and boiled oil,	2 46	
279 gallons kerosene,	46 33	
Lamp chimnies, wicks, wicking and matches,	6 34	
817 lbs. wipers,	56 71	
22 " tripoli and rotten stone,	2 20	
Emery cloth, asphaltum and concentrated lye,	22 09	
481 lbs. hemlock extract,	19 24	
Ice,	15 00	
Total used,		$4,445 06
Total accounted for,		$4,625 66

Taking value of material consumed as above:

Fuel,	$3,914 92	
Oils, packing, &c.,	530 14	
And adding engineer's and firemen's wages,	3,480 00	
Repairs to pumping machinery,	320 44	
Repairs to boiler arches,	8 50	
Makes total cost of running pumping engines,		$8,254 00
Cost per million gallons pumped,	$ 8 74	
" " " raised 100 feet	8 04	
Cost of fuel per million gallons pumped,	4 14	
" " " " raised 100 feet,	3 81	
Taking whole amount paid for current expenses during the year,		$11,030 37
The cost per million gallons pumped is	$11 68	
" " " raised 100 feet is	$10 75	

The following table shows by months, the quantity of water pumped as indicated by the strokes of the pumps; the number of fire alarms; number of hours run by high pressure engine and rotary pumps, and the number of hours run for fire service:

Month.	*Gallons Pumped by Piston engines and pumps at 40 lbs. pressure.*	*Gallons Pumped by H. P. engine and rotary pumps at 40 lbs.*	*No. gals. pumped at fire pressure, 90 lbs.*	*Total gallons pumped.*	*No. fire alarms.*	*Hours run by H. P. engine.*	*Hours run for fire.*
January,	72,654,400	700,380	212,000	73,566,780	3	5½	1 45
February,	65,100,360	2,144,701	468,000	67,713,061	1	21	3
March,	71,812,960	2,130,850	662,800	74,606,610	6	23	4 30
April,	72,696,000	520,410	324,230	73,540,640	5	4	2
May,	71,749,600	120,940	165,000	72,035,540	3	2	55
June,	76,882,328	1,095,000	237,000	78,214,328	3	9	30
July,	89,519,752	238,000	87,400	89,845,152	4	2	30
August,	87,558,000	4,750,380	3,869,790	96,178,170	12	54	11 10
Septemb'r,	81,068,000	2,220,000	1,638,070	84,926,070	7	36	8
October,	76,084,000	736,000	1,670,000	78,490,000	5	7	8
Novemb'r,	80,279,992	1,120,000	4,003,600	85,403,592	6	8	20
December,	69,212,000	403,000	247,100	69,862,100	6	5	1 35
Totals,	914,617,392	16,179,661	13,584,990	944,382,043	61	176½	61 55

The following table shows the quantity of water pumped during each year since the works commenced operations:

1873,	142,477,725 gallons.	1878,	530,197,397 gallons.
1874,	294,714,798 "	1879,	672,344,128 "
1875,	416,756,579 "	1880,	827,067,372 "
1876,	518,197,129 "	1881,	944,382,043 "
1877,	538,847,186 "		

The number of service taps connected with the main pipes during the year was 123, of which 102 were connected with Wyckoff pipes and 21 with iron pipes.

Of these taps 23 were for additional supply to premises heretofore supplied and 100 were for supply to new premises.

One half-inch tap was taken out during the year. leaving whole number of taps connected with the main pipes at the close of 1881, 922.

Two new branch connections have been put in during the year.

One of 4 inch.

One of 3 inch.

And one 5 inch branch connection taken out and pipe plugged, leaving number of branch pipes leading into private property 22, and one 2 inch branch connection leading into Washington Park.

The following table shows the number and size of service taps and kind of main pipe connected with during the year:

	½ in.	⅝ in.	¾ in.	1 in.	Totals.
With Iron Mains, - - -	9	2	6	4	21
With Wyckoff Mains, - -	27	22	32	21	102
Totals, - - - -	36	24	38	25	123

Total services attachments connected with main pipes to date:

	⅜ in.	½ in.	⅝ in.	¾ in.	1 in.	1¼ in.	2 in.	Total
With Iron Mains, -	5	66	24	46	41	6	2	190
With Wyckoff Mains,	–	274	24	327	94		13	732
Totals, -	5	340	48	373	135	6	15	922

Of these service attachments,

One 2-inch connected with Wyckoff pipe.
One 1-inch " " " "
One 1¼ inch " " Iron pipe.
One 1-inch " " "

are for waste pipes into sewers, and have no services connected.

List of branch services connected with main pipes:

One 8-inch.
Four 6-inch.
Thirteen 4-inch.
Four 3-inch.

Total, - 22.

Besides one 2-inch branch service into Washington park.

In the pipes leading from these branches are the following service attachments:

Four ½-inch.
Three ¾-inch.
Eight 1-inch.
Nine 2-inch.

Total, - 24.

Making total number of service attachments besides brances, 946.

Six meters have been set since the last of November.

Two of these are 4-inch meters, and four are 3-inch meters.

There is now on hand ready for setting:—one 4-inch meter; one 3-inch meter; three 2-inch meters; one 1½-inch meter; three 1-inch meters; one ¾-inch meter; one ⅝-inch meter.

The amount of the regular Assessment Roll for 1882, is 11,875.00, not including the rates for mills, salt blocks and drill houses.

The amount received during the past year from these sources was $4,015.55 including the amount paid for hydrant and hose rates at the mills.

The regular assessment as above footed is for the following uses of water:

504 Private dwellings.
110 Families in blocks.
160 Lawn hose.
109 Baths in private houses
182 W. C. in private houses
72 Private stables.
5 Bakeries.
3 Banks.
1 County court house.
1 County jail.
3 Churches.
2 Clothes cleaning.
1 Cracker factory.
3 Carriage shops.
1 Electric light works.
1 Gas works.
3 Founderies.
3 Harness shops.
1 Hose for cleaning tug boilers.
1 Hospital.
22 Hotels.
3 Hotel stables.
5 Halls and lodge rooms.
1 Hydraulic elevator.
1 Laundry.
1 Library building.
12 Livery stables.
5 Machine shops.
12 Mill stables.
2 Mortar yards.
7 Barber shops.
3 Bath houses.
6 Blacksmith shops.
31 Boarding houses.
4 Bottling works.
17 Butcher shops.
1 Brewery.
1 Boiler shop.
67 Offices.
5 Planing mills.
2 Passenger depots.
4 Photograph galleries.
3 Plumber shops.
4 Printing offices.
10 Restaurants.
2 Root beer works.
2 Round houses.
83 Saloons and bars.
1 Salt crusher.
6 School buildings.
1 Spoke factory.
85 Stores.
1 Street car stable.
1 Steam laundry.
2 Telegraph offices.
1 Water moter.
2 Wood yards.
160 Water closets in hotels. stores, depots, &c.

Water is supplied for the following uses for which no assessment is made:

1 City building, police station and city offices.
3 City hose houses and stables.
11 Public drinking fountains.
2 Ornamental fountains in pubic square.
2 Public parks.
8 Water closets and urinals in city buildings.
138 Public fire hydrants kept in repair and working order at the expense of the Water Works Department.

The supply from 15 service connections have been discontinued and new services put in for supplying the same premises.

15 services are also shut off by reason of the buildings on the premises having been burned or removed and not rebuilt.

60 services are shut off for non-payment of water rates or by request as follows:

Vacant buildings, 14.	Lawn hose, 11.
Occupied dwellings, 24.	Blacksmith shops, 2
Stables, 3.	Boarding house, 1.
Stores, 4.	Street sprinkler hydrant, 1

14 services have not yet been turned on by reason of either the buildings or plumbing work not being completed.

The uses described as mill and salt works uses, and from which $4,015 55 was received during the year 1881, were as follows:

58 Hose connections put in for fire protection.
6 Batteries of saw mill boilers.
5 Batteries of salt block boilers.
10 Drill house boilers.
14 Small hose in drill houses and salt blocks.
7 Batteries of mill boilers for cleaning only.

Of these,

12 Hose connections put in for fire protection.
5 Batteries of saw mill boilers.
2 Batteries of salt block boilers.
1 Drill house boiler,

are now being supplied through meters, the charges by meter measurement commeencing Jan. 1st, 1882.

The amount of water rates remaining uncollected on the roll of 1881, at the close of the year, was $700, of which amount $113 was from saw mill and salt block rates; over $500 of the amount uncollected will probably be paid in a short time.

The following table shows the amount of water rates collected, and total of roll for each year since the works commenced operations:

Years.	*Amount Collected.*	*Amount Uncollected.*	*Total of Roll.*
1873, January 1st to Aprll 30th,	$ 728 82	....	$ 728 82
1873-4, May 1st, '73, to April 30th, '74,	5,440 80	$ 1 60	5,442 40
1874-5, May 1st, '74, to April 30th, '75,	6,908 16	44 85	6,953 01
1875, May 1st to December 31st,	7,269 55	28 46	7,298 01
1876,	9,571 26	82 73	9,653 99
1877,	9,599 26	139 19	9,738 45
1878,	10,069 40	333 46	10,402 86
1879,	11,699 60	145 44	11,845 04
1880,	13,021 88	259 11	13,280 99
1881,	14,525 01	700 00	15,225 01
Totals,	$88,833 74	$1,734 84	$90,568 58

Trial balance sheet for 1881:

DR. BALANCES.

Folio 1,	City Treasurer,	$2,360 11
" 4,	Treasurer of Board,	26 61
" 13,	Office expenses and Secretary's salary,	1, 677 22
" 14,	Engineer's and Firemen's wages,	3,480 00
" 15,	Fuel account,	4,264 42
" 16,	Oil, packing and engineer's supplies,	522 94
" 17,	Repairs to pumping machinery,	320 44

"	18, Repairs to boiler arches,	8 50	
"	18, Repairs to engine house,	113 57	
"	21, Repairs and care of hydrants, valves and pipes,	858 01	
"	20, Implement account on repairs,	78 22	
"	44, Pumping machinery,	94 62	
"	44, Valve account,	40 45	
"	42, Iron pipe and branch castings,	9 94	
"	44, Water meter account,	1,564 68	

CR. BALANCES.

Folio	8, Water rates roll of 1878,		$ 3 50
"	8, " " 1879,		4 41
"	9, " " 1880,		227 64
"	12, " " 1881,		14,525 01
"	36, Plumber's license,		25 00
"	36, Rents and dockage account,		65 00
"	36, Service stop box account,		14 70
"	37, Service tap account,		233 47
"	35, Dolsen, Chapin & Co.,		321 00
		$15,419 73	$15,419 73

Ledger Balances December 31st, 1881:

DR. BALANCES.

Folio	482, Real estate,	$ 6,724 83
"	482, Dock, tramway and store shed,	1,882 63
"	482, Engine house, chimney and wells,	19,097 42
"	483, Engine foundations, boiler foundations and arches,	4,931 72
"	483, Inlet from river,	3,218 99
"	483, Inlet from bay,	84,778 37
"	484, Reservoir and breakwater at bay,	21,491 78
"	484, Filter at bay,	1,683 13
"	484, Pumping machinery,	39,109 64
"	485, Iron pipe and branch castings,	52,718 97
"	485, Wyckoff patent pipe,	67,683 68
"	485, Laying street mains,	31,890 77
"	486, Valves for street mains,	8,585 51
"	486, Public fire hydrants,	7,274 99
"	486, Furniture and fixtures,	601 92
"	487, Implements used on construction,	1,713 61
"	487, Engineering and general superintendance on constructions,	7,856 17
"	487, Traveling expenses on construction,	306 29
"	488, Interest, discounts and commissions on construction,	4,224 17
"	488, Insurance account on construction,	29 00
"	489, Water meter account,	1,636 16
"	489, Service stop box account,	75
"	490, Water works fund,	10,282 56
"	490, Orin Bump, Treasurer of Board,	356 46
"	490, Rorison & McKinney,	19 40
"	491, Thomas Rosa,	15 57
"	491, A. L. Stewart,	15 00

"	491, Campbell & Church,	4 00	
"	412, Office expenses and salary account,	15,227 78	
"	412, Engineer's and firemen's wages,	31,472 84	
"	413, Fuel account,	23,262 23	
"	413, Oil, packing and engineer's supplies,	3,698 89	
"	414, Repairs to pumping machiney,	1,747 33	
"	414, Repairs to boiler arches,	511 18	
"	415, Repairs to engine house and insurance,	418 69	
"	415, Repairs to dock,	13 38	
"	416, Repairs to reservoir and break water,	84 50	
"	416, Repairs and care of hydrants, valves and pipes,	4,672 99	
"	417, Implements on repairs,	579 46	

CR. BALANCES.

Folio	481, Bay City Bond account, ($377,000,)		$368,045 87
"	481, Water assesssment, frontage on pipe,		736 07
"	489, Service tap account,		925 30
"	411, Rents and dockage account,		772 33
"	411, Plumber's licenses,		188 45
"	409, Water rates rolls from 1872-1878,		49,587 25
"	409, " roll of 1879,		11,699 60
"	410, " " 1880,		13,021 88
"	410, " " 1881,		14,525 01
"	492, Dolsen, Chapin & Co.,		321 00
		$459,822 76.	$459,822 76

The usual annual examination of the books of the office was made last January and I append hereto a copy of the accountants report of such examination. I again ask the Board to request the City Council to appoint a committee to make this examination for the past year.

Respectfully submitted,

E. L. DUNBAR,

Superintendent and Secretary.

Bay City, January 13th, 1881.

REPORT OF ACCOUNTANTS.

To the Honorable Board of Water Commissioners of the City of Bay City:

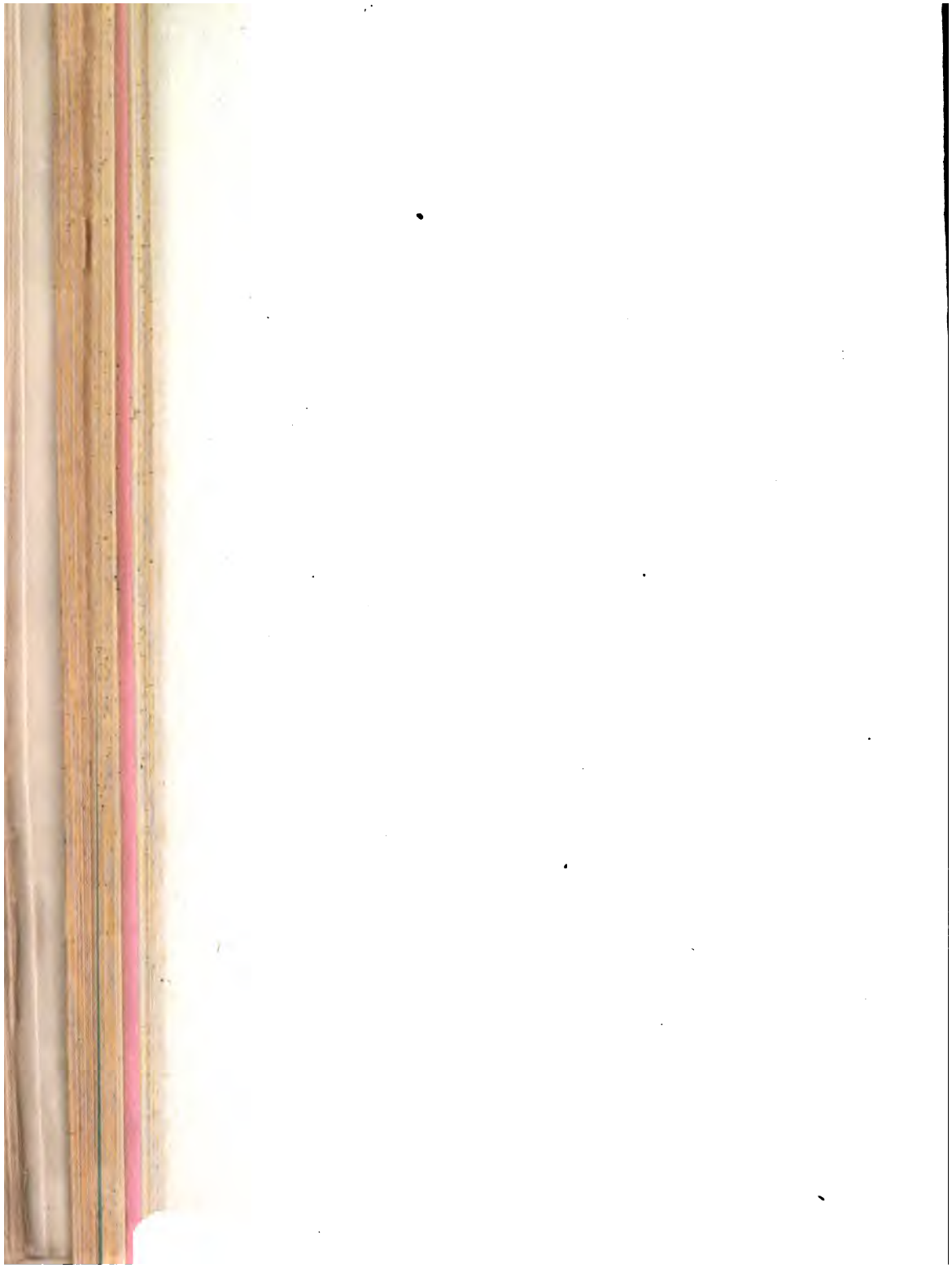
GENTLEMEN:—We, the undersigned accountants, employed to examine the books and accounts of the Bay City Water Works for the year 1880, would respectfully report as follows:

That we have carefully examined the records, vouchers, accounts and books of the Secretary, and find them correct in every particular.

We have also examined particularly all assessment rolls, and have compared the same with the stubs of receipts and find that they agree with the daily record of receipts as also with the day book, and we find the ledger balances correct as appears by the trial balance of the Secretary, January 1st, 1881, in his Ninth Annual Report, dated January 11th, 1881.

(Signed,) DAN'L A. MARSHALL,
C. F. BRAMAN,
Accountants.

Dated January 31st, 1881.



ELEVENTH

Annual Report

OF THE

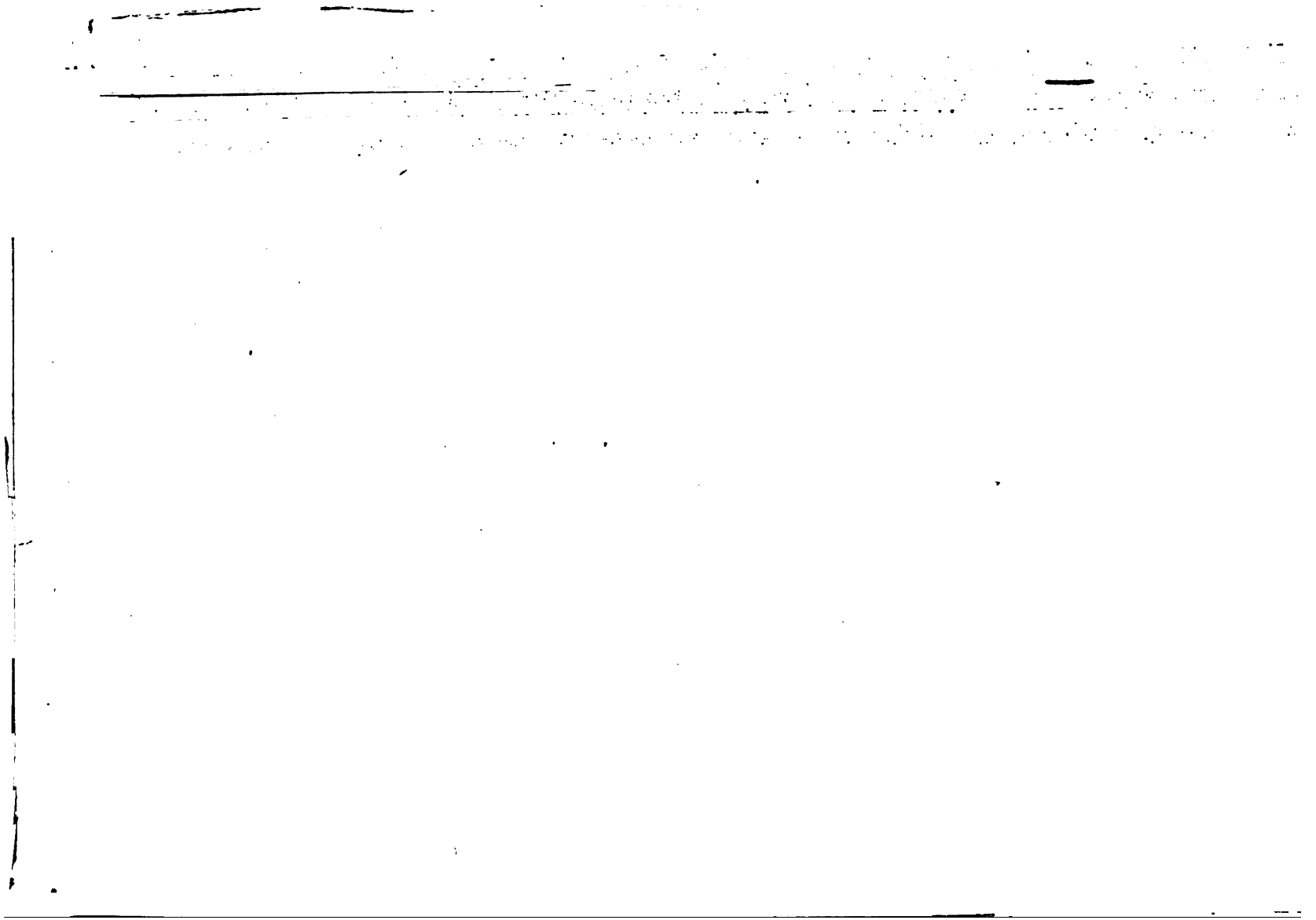
SUPERINTENDENT OF

WATER WORKS,

BAY CITY, MICH.

for 1882.

BAY CITY, MICH.
O W. Booth, City Printer.
1883.



ELEVENTH

Annual Report

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SUPERINTENDENT OF

WATER ✦ WORKS,

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BAY CITY, MICH.
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1883.

BOARD OF WATER WORKS.

January 1, 1883.

First Ward,	Andrew Walton.
Second Ward,	Thomas Cranage, Jr.
Third Ward,	William Westover.
Fourth Ward,	William Smalley.
Fifth Ward,	Charles E. Young.
Sixth Ward,	Duncan McGregor.
Seventh Ward,	George C. Meyers.

OFFICERS.

President of Board,	William Westover.
Sup't and Sec'y,	E. L. Dunbar.
First Engineer,	A. B. Verity.
Second Engineer,	Fred. H. Holly.

mbers of Board of Water Works

From Date of Organization.

FIRST WARD.

HAEL DAILY, appointed Sept. 6, 1871; resigned May 13, 1872.
REW WALTON, appointed May 27, 1872,
REW WALTON, re-appointed Dec. 9, 1872.
REW WALTON, re-appointed Feb. 4, 1878.
REW WALTON, re-appointed Jan. 22, 1883; term expires Sept. 3, 1887.

SECOND WARD.

ES SHEARER, appointed Sept. 6, 1871; term expired Sept. 6, 873.
MAS CRANAGE, Jr., appointed Nov. 3, 1873.
MAS CRANAGE, Jr., re-appointed Sept. 2, 1878; term expires Sept, 6, 1883.

THIRD WARD

. WESTOVER, appointed Sept. 6, 1871.
. WESTOVER, re-appointed March 29, 1875.
. WESTOVER, re appointed Oct. 20, 1879; term expires Sept. 3, 1884.

FOURTH WARD.

N McDOWELL, appointed Sept. 6, 1871; died May 11, 1872.
. SMALLEY, appointed May 27, 1872.
. SMALLEY, re-appointed Feb. 4, 1878.
. SMALLEY, re-appointed Dec. 13, '80; term expires Sept. 6,'85.

FIFTH WARD.

RY M. BRADLEY, appointed Sept. 6, 1871.
RY M. RADLEY, re-appointed Feb. 4,'78; resigned May 3,'80.
S. E. YOUNG, appointed June 1, 1880.
S. E. YOUNG, re-appointed Sept. 5,'81; term expires Sept. 6,'86

SIXTH WARD.

REW J. MILLER, appointed Aug. 4, 1873; term expired Aug. 4, 1874.
CLARKE, appointed Oct, 13, 1874; term expired Aug. 4, 1879.
. DAGLISH, appointed Oct. 20, 1879; resigned Oct. 24, 1881.
NCAN McGREGOR, appointed Oct. 31, 1881 ; term expires Aug. 4, 1884.

SEVENTH WARD.

S. H. McGRAW, appointed Aug, 4, 1873; resigned Sept. 14, '74.
C. McCLURE, appointed Sept. 21, 1874.
C. McCLURE, re appointed Nov. 8, 1875; resigned March 24, '79.
. C. MEYERS, appointed May 5, 1879.
. C. MEYERS, re-appointed Dec. 13, '80; term expires Aug. 4,'85.

To the Honorable Board of Water Commissioners of Bay City:—

GENTLEMEN—I have the honor to submit my Eleventh Annual Report, showing the operations of the Works during the year 1882.

The year covered by this report has been the most successful, financially, of any since the works were inaugurated, the increased revenue and reduced expenses, combined with the large reduction in the quantity of water pumped, have enabled the Board to materially extend the meter system commenced in the preceding year; lay nearly three-fourths of a mile of new pipe, and still show an increase in the cash balance under the control of the Board, of $1,774 42.

RECEIPTS.

The receipts for the year have been as follows:

From Water Rates, Roll of 1879	$ 2 50		
" " Roll of 1880	105 44		
" " Roll of 1881	396 35		
" " Roll of 1882	16,878 39		
Total from Water Rates			$17,382 68
From Plumbers' Licenses	23 25		
" Rent of Boom	65 00		
" Sale of scrap leather	2 85		
" Labor on repairs	19 75	110 85	
" Sale of service taps		391 50	
" Sale of service stop boxes		19 53	
" Dock account		4 00	
" Fire hydrant account		2 33	
Total cash collections for the year			$17,910 71

ease in cash collections over 1881	$2,550 60
ease in cash collections from water rates over 1881	$2,622 12
re remains uncollected on the roll of 1882	$641 93
ing total amount of roll	$17,520 32
increase over roll of 1881 of	$2,295 31

DISBURSEMENTS.

The expenditures for the year, as per reports bmitted to the City Council each month, have en as follows:

uary	$ 816 36	July	$1,971 79
ruary	948 60	August	1,052 78
rch	830 27	September	862 35
ril	1,057 10	October	828 24
y	1,726 21	November	1,295 04
ne	3,437 05	December	1,310 50

Total expenditures for 1882, $16,136 29.

These expenditures have been for the following neral accounts:

r Office Expenses	$ 278 65	
Superintendent and Secretary's Salary	1,500 00	
Repairs to Engine House	4 20	
Repairs to Breakwater at Bay	372 96	
Repairs and care of Hydrants, Valves and Pipes	711 19	
Implements on Repairs and Repairing Tools	69 66	
Total current expenses except pumping		$2,936 66
r Engineers' and Firemen's Wages	3,600 00	
Fuel account	3,376 45	
Oil, Packing and Engineers' Supplies	342 47	
Repairs to Pumping Machinery	225 39	
Repairs to Boiler Arches	29 75	
Total Pumping Expenses		$ 7,574 06
Total for current expenses		10,510 72
r Service Tap account	135 66	
Service Stop Boxes	37 45	
Water Meters	2,934 09	
Iron Pipe account	24 39	
Wyckoff Pipe account	1,886 03	
Valves	152 15	
Fire Hydrants	65 78	
Laying Pipe	390 02	
Total construction expenses		$ 5,625 57
Total expenditures		$16,136 29

The expenditures for current expenses, except umping, exceed the expenditures for the same pur- ose in 1881, $182 89, owing to the repairs rendered

necessary at the Bay by the high water and heavy winds which prevailed during the early part of the season, and a large amount of extra work required on the main pipes, changing their location to make way for sewers crossing them at grade; also a number of breakages in service pipes caused by the carelessness of persons employed in laying sewers in the alleys where water pipes are located.

The expenditures for pumping expenses are less than for the preceding year $702 54, the saving being mainly in fuel and oil and packing, caused by the less quantity of water pumped.

The details of the expenditures for current expenses are as follows:

For office expenses—

For Printing Superintendent's Report for 1881	$	20 00
Accountant's examining Secretary's books for 1881		24 50
Printing and binding Order and Record books		13 00
Printing and binding Plumbers' returns		3 50
Printing notices		6 50
Printing daily and monthly engine records		20 00
Memorandum books and tablets		2 90
Paper, envelopes, pens and ink		12 75
Letter file and file binders		2 30
Binding reports (other cities)		2 00
Coal for office		18 00
Cleaning office and carrying up coal		2 35
Exchange on drafts		3 35
Rent of Telephone in office from April 20		27 90
Clerk hire		95 00
Fitting up vault and carpet for office		24 60
Total office expenses	$	278 65

For Superintendent and Secretary's salary:

Salary of Superintendent and Secretary, 12 months	$1,500 00

For repairs to Engine House:

Nails and paint	4 20

For repairs to Breakwater at Bay:

5,500 feet oak plank	$	110 00
Pile driver redriving sheet piling		187 50

bor redriving sheet piling by hand, and refilling reservoir bank	68 25
lbs nails and spikes	7 21
	$ 372 96

For repairs and care of hydrants, valves and pes:

chine shop repairs on hydrants and valves	$ 16 25
ipes for elevating hydrants to grade	30 99
bor on pipes at sewer crossings	28 37
ck section and man-hole at First st. sewer crossing	50 66
w pipe for changing grade at sewer crossings	19 62
bor and pipe for lowering pipe in area in front of Plumsteel Block	30 78
pairing pipe undermined at Dennison's Block	12 87
pairing service pipes broken by sewer contractors	18 58
bor examining, cleaning and repairing hydrants, valves and pipes, and turning on and shutting off water	420 31
bor repairing 13 leaks in Wyckoff Pipe	45 75
lve cases and valve case covers	21 27
pairing hydrant for filling street sprinkler	8 85
ather, drayage, oil, etc	6 89
	$ 711 19

For Implement account:

pairing picks, chisels, etc	15 88
e of scales for taking inventory	3 00
ndles, shovels, etc	7 80
heelbarrows, wrenches, pails	10 45
ain, hooks, cold-chisels	4 95
e, saw, brace and bits	8 40
mps, files, wrenches	14 98
se, oil-cans, brushes, shoe knife	2 45
rinkler, etc., for office	1 75
	$ 69 66

For Engineers' and Firemen's wages:

rst Engineer's salary one year	$1,200 00
cond Engineer's salary one year	960 00
vo Firemen one year	1,320 00
tra Fireman for service during fires	120 00
	$3,600 00

For Fuel account:

6 cords slabs @ $1 25, delivered	$ 807 50
765¼ cords slabs and edgings @ 90c delivered	1,588 95
8 cords slabs and edgings @ 75c on mill yard	381 00
0 cords slabs and edgings @ 70c on mill yard	350 00
elivering 1,008 cords	249 00
	$3,376 45

For Oil and Packing:

Lubricating oils and tallow	$ 89 23
Cleaning material, wipers, etc	45 32
Rubber, cotton and hemp packing	50 73
Potash, lye, etc., for cleaning boilers	42 71
Leather and rivets, for pump valves	32 93
Red lead and oil	2 41
Beeswax, plumbago, etc	1 55
Emery and sandpaper	1 25
Sheet brass and copper, etc	2 95
Marlin, rope, canvas, etc	2 56
Brooms	3 50
Ice	10 00
Kerosene oil	49 89
Wicks and chimneys	7 40
	$ 342 47

For repairs to Pumping Machinery:

Three sets brasses and freight on same	12 05
5½ lbs. sheet brass	2 20
Gas pipe, fittings, air-cocks, etc	14 53
New pins and fitting brasses, 2 engines	27 44
Repairs on main piston pumps	31 48
Repairs on pony pump	2 47
Repairs on feed pumps	19 08
Repairs on old oil cups	1 10
New oil cup and fittings	32 64
Repairing counter	2 10
Repairing boiler	1 60
Grates for boiler	68 36
Paint for engines	10 05
Blank nuts	49
	$ 225 59

For repairs to Boiler Arches:

Fire brick and fire clay	$ 13 50
Labor repairing lining to arches	16 25
	$ 29 75

The amount paid for office expenses exceeds the amount paid in 1881 $101 43, the increase being occasioned by placing a telephone in the office, and the employment of a clerk to assist in making collections during the latter portion of the year, both of which have been rendered necessary by the increased business of the office, and will necessarily be

ermanent additions to the expenses of the office ereafter.

The extreme high water and heavy northerly inds prevailing during the early part of the season used considerable damage to the works at the Bay. he planks which were driven in 1876 and 1877 are ecoming decayed, and when heavy logs are driven gainst them, with a strong sea running. they are ble to break through, and when this occurs the as make short work of washing a hole through e bank. This has occurred twice during the sea-n, but the breaks have been repaired before much mage had been done, aside from riling the water the reservoir. About 250 feet of sheet piling has en re-driven with oak plank. Probably about 500 et will require re-driving during the coming season

There has been no leaks or breaks in the iron ains during the year.

The number of leaks in Wyckoff Pipe was 13, one of which were of such a nature as to require ew pipe, all of them having been repaired by calk-g or plugging; 11 of these leaks were in joints, nd 2 were knot holes.

The lines of water pipe have been intersected by ewers in process of construction at five different oints. In three eases the formor location of the sewer as changed to leave the water pipes undisturbed, nd in the other two cases the water pipe was raised lowered to leave a clear passage-way for the ewer at its proper grade. The expense of all hanges in sewers and water mains from this cause as been paid by the Board.

Seven service pipes and connections have been roken by the laborers employed in laying

sewers, the expense of repairing which has been paid by this Board. In a number of places the grade of streets has been raised since the water pipes were laid, rendering it necessary to make some changes in the fire hydrants, to bring them to the proper grade. Five hydrants have been raised by lengthening the barrell, and several others will require raising in the Spring.

WATER PUMPED AND COST OF PUMPING.

The total quantity of water pumped during the year, as indicated by the revolutions of the pumps (assuming that the pumps deliver their full capacity into the mains at each stroke), was 775,642,466 gallons, which is 168,739,577 gallons less than was pumped during the preceding year; 769,705,446 gallons were pumped under the ordinary domestic pressure of 40 lbs. per square inch at the pressure-gauge, which is equivalent to a lift of 107 feet from the surface of the water in the wells; and 5,937,020 gallons were pumped under a fire pressure averaging 78 lbs. per square inch at the pressure-gauge, which is equivalent to a lift of 195 feet from the surface of the water in the wells.

The cost of pumping this quantity of water has been as follows:

Cost of fuel consumed	$3,437 70
Lubricating oils consumed	109 86
Packing and leather consumed	86 35
Wipers and cleansing material consumed	52 75
Material for cleaning boilers consumed	24 01
Gas-pipe fitting and brasses used	18 36
Grate bars used	68 36
Kerosene oil for lights used	53 89
Ice used	10 00
Machine shop work on repairs	127 96
Repairs to boiler arches	29 75
Engineers' and Firemen's wages	3,600 00
	$7,618 97

per million gallons pumped..... ....$ 9 82
per million gallons raised 100 feet..... 9 12
of fuel per million gallons pumped..... 4 56
of fuel per million gallons raised 100 feet..... 4 12

The following table shows the quantity of wa- pumped during each month of the year by ton pumps and rotary pumps; also number of alarms and quantity of water pumped under fire ssure.

Month.	PISTONS.		H. P. Engine and Rotary Pumps.		Total gallons pumped.	FIRES.		
	Hours run	Gallons pumped.	Hours run	Gallons pumped		No. Alarms	Hours run	Gallons pumped,
January....	730:30	70,767,820	14:00	1,350,000	72,117,820	4	3:30	564,000
February....	664:10	61,081,800	8:05	832,400	61,914,200	4	1:38	215,228
March.....	733:57	62,557,040	10:03	987,040	63,544,080	2	1:07	124,540
April.....	715:00	61,546,316	5:00	511,880	62,058,196	4	1:34	211,068
May.....	740:52	62,303,228	3:08	319,980	62,623,208	5	1:37	175,084
June.....	719:05	59,711,496	1:05	105,220	59,816,716	7	3:43	403,988
July.....	737:30	67,197,988	14:40	1,424,060	68,622,048	14	13:24	2,165,316
August.....	742:14	68,158,064	3:26	308,340	68,466,404	8	8:07	1,100,460
September..	716:27	66,486,056	4:08	401,080	66,887,136	8	3:01	380,792
October.....	742:45	66,417,988	1:15	121,760	66,539,748	2	1:32	164,008
November...	717:01	60,192,860	2:59	285,620	60,478,480	2	3:03	349,752
December....	742:55	62,474,750	1:05	99,680	62,574,430	1	40	82,784
Totals...	8,702:26	768,895,406	68:54	6,747,060	775,642,466	61	42:56	5,937,020

The large reduction in the quantity of water pumped has enabled the Works to respond promptly and satisfactorily to every demand for fire pressure, and furnish thoroughly efficient fire protection to the city, without excessive strain on the pumping machinery ; but the severe strain to which the machinery was subjected during the preceding year has told permanently against the reliability of the Works, and while the *capacity* of the Works seems to be ample while running at the moderate speed of the past year, they are now liable to breakage while running at moderate speed and pressure, and I think it will prove truer economy for the city to put in a new and improved set of machinery, than to expend any large sum on repairs to the machinery now in use, which has seen ten years of constant—and during a portion of the time extremely hard--service. One new piston pump to replace the left back pump is now being made and will be put in during the present winter, should no immediate action be taken toward the purchase of a new set of machinery, it will probably be necessary to replace other of the pumps next winter. The steam cylinders are in as good condition as when first started. The only difficulty appears to be in the pumps and discharge pipes and valves, which have become badly rust-eaten and weakened from the excsssive strains to which they have been subjected.

The following table shows the quantity of ter pumped each year since the works com-nced operations:

r.	Gals.	Year.	Gals.
....	142,477,725	1878	530,197,397
....	294,714,798	1879	672,344,128
....	416,756,579	1880	827,067,372
....	518,197,129	1881	944,382,043
....	538,847,186	1882	775,642,466

SERVICE CONNECTIONS.

The number of service connections inserted in e main pipes during the year was 114, of which 8 e connected with iron mains, and 106 are connect- with Wyckoff mains; whole number of service nnections (besides branch castings), connected th main pipes, 1,034.

The service attachments connected with the ins during the year have been of the following es:

	½ in.	⅝ in.	¾ in.	1 in.	Total.
th Iron Mains	3	2	2	1	8
th Wyckoff Mains	38	26	29	13	106
Total	41	28	31	14	114

Description of all service connections in main pes to date:

	⅝in.	¾in.	⅞in.	1 in.	1¼in.	2 in.	Total
ith Iron Mains	5	68	26	48	41	6	2	196
ith Wyckoff Mains	–	312	49	357	107	–	13	838
Total	5	380	75	405	148	6	15	1,034

	2 in.	4 in.	6 in.	8 in	Total
anches	1	17	4	1	23

Of the above, 28 are shut off at the main pipe, ew service connections having been put in to sup-ly the same premises, leaving 1,029 with service ipe connected, supplying 1,046 separate services.

WATER METERS.

The number of water meters set during the year was 22, making whole number set at the present time 28, of the following sizes and kinds:

	¾in.	1 in.	1½ in.	2 in.	3 in.	4 in.	8 in.	*Total*
Union Rotary...		2	4	3	13	4	1	27
Crown..... ...	1							1
Total.....	1	2	4	3	13	4	1	28

The experience of the past year has demonstrated beyond a doubt that the use of meters is the only practical plan for preventing the waste of water and for equalizing the rates to be paid by consumers according to the quantity of water used. Notwithstanding an increase of 12 per cent. in the number of service connections, the quantity of water pumped has been reduced 18 per eent. It is not to be supposed that the entire amount saved has been from the few services metered; the moral effect upon the smaller consumers of metering the larger ones, has been salutary, but this will not be permanent unless the meter system is extended as fast as possible. The number of meters set and in operation at the commencement of the year was 6, and the meters set during the year were set in operation by months, as follows: January, 2; February, 3; March, 1; April, 2; May, 6; June, 6; November, 1; December, 1, making the average number of months that the meters have been in operation during the year a little less than nine. The quantity of water supplied through the 28 meters during the year was 64,774,239 gallons, of which 1,740,260 gallons were supplied to premises where rates had been previously paid at assessment rates, and consequently was not charged at meter rates; 5,548,848 gallons have been given away by resolution of the Board, giving

nsumers a rebate on account of undiscovered eaks in service pipes on private premises, which uld only be detected at the monthly reading of e meters, leaving actual amount of metered water om which revenue was derived 57,485,131 gallons.

The revenue derived from the water passing rough the meters was $3,702 33, or nearly 6.4 nts per 1,000 gallons on the quantity charged r, or a little more than 5.7 cents per 000 gallons on the entire quantity passed rough meters. Taking entire quantity of water umped, as indicated by the stroke of the pump-, 75,642,466 gallons, and deducting 10 per cent. for ip in pumps and open air-cocks, leaves actual uantity of water delivered into mains 698,078,220 allons. Assuming that 25 per cent. of this water oes for public uses, such as public drinking foun- ains, ornamental fountains, flushing sewers, use of ire Department, etc., would leave 524,558,665 gal- ns as the quantity supplied to consumers; deduct- ng the quantity passed through meters, 64,774,239 allons, leaves 459,764,426 gallons supplied under he assessment rate, from which the revenue derived as $13,821 49, or a trifle more than 3 cents per 1,000 allons.

The principal object in introducing meters was o curtail the waste of water, and the idea prevailed o some extent that it would also reduce the reve- ue derived from the sale of water. If, on lhe con- rary, it has had a tendency to increase the revenue, his becomes an additional argument in favor of the ontinuance and extension of the meter system. The evenue for the past year has been a little more than

2¼ cents per 1,000 gallons on all the water pumped, as indicated by the strokes of the pumps, which is the highest amount received per 1,000 gallons pumped since 1874.

The increase in the number of services for 1882 was about 12 per cent., while the increase in the revenue was 15 per cent.

DISTRIBUTING MAINS.

Main pipes have been laid during the year in alley between Jefferson and Madison streets from Tenth to Eleventh streets; on Eleventh street from alley between Jefferson and Madison streets to Madison street; on Madison street from Eleventh to Thirteenth street; and on Farragut street from Center to Tenth street.

The length, size and kind of pipe laid on the different lines is as follows:

In alley between Jefferson and Madison streets:

8 inch iron pipe	2 ft. 9 in	
8 " Wyckoff pipe	826 "	
		828 ft. 9 in

On Eleventh street.

8 inch iron pipe, branches and curves	7 ft.	
8 inch Wyckoff pipe	163 "	
4 " " " to hydrant	16 " 6 in	
		186 ft. 6 in

On Madison street.

8 inch iron pipe, branches and curves	4 ft. 6 in	
8 " Wyckoff pipe	674 "	
		678 ft. 6 in

On Farragut street.

4 inch iron pipe branches	4 ft.	
4 " Wyckoff pipe, main line	1,779 "	
4 " Wyckoff pipe to hydrant	13 "	
		1,796 ft.

The 6 inch Wykoff pipe on Thirteenth street was cut at the point where the Madison street line

ntersects it and an 8x6 inch cross, three feet long, nserted with sleeve.

The 6 inch Wyckoff pipe on Tenth street was lso cut at the point where the Farragut street line ntersects it and a 6x4 inch cross, 4 feet long, inerted with sleeve.

Total length of pipe laid.

8 inch iron and branches		14 ft. 3 in
8 " Wyckoff	1,663	"
6 " Iron (branches)	7	"
4 " " "	4	"
4 " Wyckoff	1,808	" 6 in
		3,496 ft. 9 in

Pipe taken out.

6 inch Wyckoff pipe	7 ft.	
et increase in length of pipeage		3,489 ft. 9 in

Total length of main pipe connected with the orks.

inch stave pipe conduit from Saginaw Bay	4 miles	66 ft.
" " " " " River		386 "
Total stave pipe conduit	.4 miles	452 ft.

Distributing mains.

	16 in.	12 in.	10 in.	8 in.	6 in.	4 in.	3in.	Total.
ron pipe	1,410	4,883	8,428	1,938½	961½	664½	...	18,285½
Vyckoff pipe			6,411	13,208½	49,153½	18,974½	319	88,066½
Total								106,352

otal iron mains	3 miles	2,445½ ft.
otal Wyckoff mains	16 "	3,586½ "
	20 miles	752 ft.

The number of new valves set during the year n connection with the distributing mains was seven, f the following sizes:

8 inch, 2.
4 " 4.
3 " 1.

Whole number of valves in use in connection vith the pipe system of the works, 283, as follows:

30 inch	Valves at Bay	1
18 "	" River	1
16 "	"	1
12 "	"	4

10	"	"	10
8	"	"	27
6	"	"	72
4	"	"	164
3	"	"	3
			283

The number of public fire hydrants set during the year was 2, both double discharge post hydrants of the Holly pattern.

Whole number of public fire hydrants set, 140.

Holly hydrants	99
Matthews' hydrants	40
Brown's hydrants	1

The pipes, hydrants and service connections are located in the several wards of the city as follows:

	Feet of Pipe.	*Fire Hydrants.*	*Service Connections.*	*Valuation on City Roll*
First Ward	18,207½	26	114	$1,120,000
Second Ward	20,894½	22	321	2,465,000
Third Ward	28,753½	30	366	2,287,000
Fourth Ward	11,401½	18	125	1,144,000
Fifth Ward	9,643½	14	55	663,000
Sixth Ward	8,891	16	35	670,000
Seventh Ward	8,560½	14	41	735,000
Totals	106,352	140	1.057	$9,084,000

ASSESSMENT RATES FOR 1883.

The regular assessment roll for 1883 amounts to $14,236 80. Estimating the amount to be derived from metered water at $4,500, and from new services $1,000, makes total estimated receipts for 1883 nearly $20,000.

The roll for 1883 embraces the following uses of water:

560 private dwellings.
111 families in blocks.
226 lawn hose.
245 water closets in private houses.
134 baths in private houses.
93 private stables.
1 ashery.
7 bakeries.
3 banks.
10 barber shops,
1 hospital,
23 hotels.
5 hotel stables.
1 hydraulic elevator.
4 laundries.
1 library.
16 livery stables.
4 machine shops.
13 mill stables.
98 offices
2 paint shops

ath houses (public).	2 passenger depots.
lacksmith shops.	4 photograph galleries.
oarding houses.	8 planing mills.
ottling works.	3 plumber shops.
rewery.	2 printing offices.
utcher shops.	1 pipe works.
ourt house.	15 restaurants.
ounty jail.	2 R. R. round houses.
hurches.	101 saloons and bars.
offee roaster.	1 salt crusher
racker factory.	6 schools.
igar factories.	1 stone yard.
arriage shops.	90 stores.
rill houses.	1 street-car barn.
Electric Light works.	2 telegraph offices.
oundries.	1 warehouse.
louring mill.	1 water motor.
as works.	206 water closets and urinals in hotels, stores, saloons, depots, etc.,
arness shops.	
alls.	

presenting 1013 assessments and 898 separate ser- pipes.

Water is supplied through 18 services for the owing described uses without charge :

ty building, police station and city offices.	2 ornamental fountains in public square.
ty hose and truck houses and stables.	2 parks.
ublic drinking fountains.	8 water closets and urinals in city buildings.

The supply from 35 services is controlled by the meters now in use, the extra number of services ng connected with main pipes beyond the meters;

22 service pipes are shut off by reason of the ldings on the premises having been burned or re- ved and not re-built.

58 services are shut off for non-payment of water es. or by request, as follows :

acant basements and shops.	4 lawn hose.
wellings.	2 stables.
rill houses.	1 saloon.
ores and warehouses	4 shops and manufactories.
ffice.	

15 services are shut off by reason of the build- s or plumbing work not being completed.

28 services are shut off and abandoned, new vices having been put in to supply the same mises.

Whole number of services open	951
Whole number of services closed	95
	1046

The services controlled by meter are for the following described uses:

16 saw mills.	2 offices.
16 salt blocks.	1 cooper shop.
20 drill houses.	1 machine shop.
8 double fire hydrants.	1 planing mill.
14 single fire hydrants.	3 stables.
27 hose connections for fire protection in mills and blocks.	1 block of stores.
	43 dwellings.
2 hose for cleaning tug boilers.	

Ledger Balances for 1882:

LEDGER BALANCES—DR.

Folio 51,	City Treasurer	$ 1,510 71
54,	O. Bump, Treasurer of Board	263 71
114,	John Young	6 50
91,	Dolson, Chapin & Co.	621 00
75,	Service stop boxes	18 10
74,	Water meter account	2,918 47
101,	Iron pipes and branch castings	24 39
101,	Wyckoff Patent Pipe	1,886 03
111,	Laying pipe	390 02
100,	Valves for street mains	152 15
111,	Public fire hydrants	63 45
112,	Office expenses and salaries	1,778 65
65	Engineers' and Firemen's wages	3,600 00
66,	Fuel	3,055 45
67,	Oil, packing, and engineers' supplies	339 62
65,	Repairs to pumping machinery	225 39
68,	Repairs to boiler arches	29 75
68,	Repairs to Engine Houses	4 20
110,	Repair and care of hydrants, valves and pipes	706 44
70,	Repairs to breakwater and reservoir	377 36
112,	Repairs to water meters	15 62
71,	Implements	69 66

LEDGER BALANCES—CR.

Folio 58,	Water Rates, Roll of 1879		2 50
58,	" Roll of 1880		105 44
59,	" Roll of 1881		396 35
62,	" Roll of 1882		16,878 39
63,	Plumbers' licenses		23 25
63,	Rents, dockage, etc		65 00
75	Service tap account		262 34
93,	Rorison & McKinney		19 40
109,	Campbell & Church		4 00
		$17,756 67	$17,756 67

ase in construction account.....	5,452 61	
ase in maintanance account.....	10,292 14	
ase in water rate balance...		$17,382 68

The following balance-sheet shows ledger bal-
es from the commencement of the Works, show-
net amount expended on each branch of the
rks since their inception:

LEDGER BALANCE—DR.

482, Real estate.....$	6,724 83
482, Dock, tramway, store shed.....	1,882 63
482, Engine house, chimney and wells.	19,097 42
483, Engine foundations, boiler foundations and arches.....	4,931 72
483, Inlet from River....	3,218 99
483, Inlet from Bay....	84,778 37
484, Reservoir and breakwater at Bay.	21,491 78
484, Filter at Bay.....	1,683 13
484, Pumping machinery.....	39,109 64
485, Iron pipe and branch castings.....	52,743 36
485, Wyckoff Patent Pipe.....	69,569 71
485, Laying pipe.....	32,280 79
486, Valves for street mains.....	8,737 66
486, Public fire hydrants.	7,338 44
486, Furniture and fixtures	601 92
487, Implements (construction).....	1,713 61
487, Engineering and general superintendence (construction).....	7,856 17
487, Traveling expenses (construction).	306 29
488, Interest, discounts and commissions (construction).....	4,224 17
488, Insurance (construction).....	29 00
489, Water meters	4,554 63
489, Service stop boxes.....	18 85
490, Water Works fund	11,793 27
490, Orrin Bump, Treasurer	620 17
491, Thomas Rosa.....	15 57
491, A. L. Stewart.....	15 00
492, John Young.....	6 50
412, Office expenses and salaries.....	17,006 43
412, Engineers' and Firemen's wages..	35,072 84
413, Fuel	26,317 68
413, Oil, packing and engineers' supplies.....	4,038 51
414, Repairs to pumping machinery....	1,972 72
414, Repairs to boiler arches	540 93
415, Repairs to Engine House.....	422 89
415, Repairs to dock.....	13 38
416, Repair and care of hydrants, valves and pipes	5,379 43
416, Repairs to breakwater and reservoir.....	461 86
417, Implements, (repairs)	649 12
417, Repairs to water meters.....	15 62

LEDGER BALANCES—CR.

Folio 481,	Bay City Bond account ($377,000 bonds)		368,045 87
481,	Water assessment, front on pipes		756 07
489,	Service tap account		1,187 64
409,	Water rates, Rolls from 1872-78		49,587 25
409,	" Roll of 1879		11,702 10
410,	" Roll of 1880		13,127 32
410,	" Roll of 1881		14,921 36
418,	" Roll of 1882		16,878 39
411,	Plumbers' licenses		211 70
411,	Rents, dockage, etc		857 53
		$477,235 03	$477,235 03
Total construction balances		372,893 11	
Total maintenance balances		91,891 41	
Total water rate balances			106,216 42

The following table shows amount collected and the total of assessment roll for each year since the Works commenced operations:

Year.	*Amount collected.*	*Uncollected,*	*Total of Roll.*
1873—Jan. 1st to April 30th	$ 728 82	.....	728 82
1873-4—May 1st to April 30th	5,440 80	1 60	5,442 40
1874-5—May 1st to April 30th	6,908 16	44 85	6,953 01
1875—May 1st to Dec. 31st	7,269 55	28 46	7,298 01
1876	9,571 26	82 73	9,653 99
1877	9,599 26	139 19	9,738 45
1878	10,069 40	333 46	10,402 86
1879	11,702 10	142 94	11,845 04
1880	13,127 32	153 67	13,280 99
1881	14,921 36	303 65	15,225 01
1882	16,878 39	641 93	17,520 32
	$106,216 42	$1,872 48	$108,088 90

The usual yearly examination of the books of this office was made after my report for the year 1881 was published.

A copy of the report of the Accountants making such examination accompanies this report.

Respectfully submitted,

E. L. DUNBAR,
Superintendent and Secretary.

Bay City, January 20th, 1883.

REPORT OF ACCOUNTANTS.

To the Honorable Board of Water Commissioners of the City of Bay City:

GENTLEMEN :—We, the undersigned account-
s employed to examine the books and accounts of
Bay City Water Works for the year 1881, would
pectfully report as follows :

That we have carefully examined the records,
chers, accounts, and books of the Secretary and
l them correct in every particular.

We have also examined particularly all assess-
nt rolls, and have compared the same with the
bs of receipts and find that they agree with the
ly record of receipts, as, also, with the day book,
l find the ledger balances correct, as appears by
trial balance of the Secretary January 1st, 1882,
his tenth annual report dated January 13th, 1882.

(Signed) DAN'L A. MARSHALL,
(") CHAS. F. BRAMAN,
Accountants.

Bay City, February 4th, 1882.

Material used in running pumping engines dur-
the year 1882 :

3480 cords of slabs,	costing	$3,437 70
234 gallons of oil,	"	107 93
Tallow, grease and plumbago	"	1 93
83 lbs. of packing	"	53 76
Packing paper, canvass and rope	"	3 29
68½ lbs. leather	"	20 52
33½ lbs. rivets	"	5 45
17 lbs. red and white lead	"	1 86
1 gal on boiled oil	"	75
2 lbs beeswax	"	70
16 lbs. Tripoli and rotten stone	"	1 80
1 lb. oxalic acid	"	25
728 lbs. wipers	"	46 78
Sandpaper, emery cloth, brooms, &c.	"	3 92
Material for cleaning boilers	"	24 01
Brasses and sheet brass	"	9 30
Gas pipe, fittings, &c.	"	9 06
Ice	"	10 00
Grate bars	"	68 36
370 gallons kerosene oil	"	50 16
Lamp wicks, chimneys, matches, &c.	"	3 73
		$3,861 26

Material for running pumping engines on hand
nuary 1st, 1883 :

5 cords slabs	costing	4 75
22 gallons Model cyl. oil	"	14 30
20 " X " "	"	7 00
1-2 " lard oil	"	50

1 lb. plumbago	27
17 1-2 lbs. ⅛ in. square rubber packing	7 60
25 lbs. 1 in. " " " "	12 50
2 air pump valves	9 38
1 1-2 lbs. gaskets for boilers	92
6 lbs, Heston packing	9 00
5 lbs. cotton packing	2 00
1 yard canvass	30
18 lbs. sole leather	5 40
4 lbs. calfskin	3 80
2 lbs. red lead	20
1 2 gallon boiled oil	40
1 lb. Tripoli, 10c.; 1 lb rottenstone, 15c.	25
1 lb. oxalic acid, 25c; 78 lbs. wipers, 3 90.	4 15
5 sheets emery, 25c.; 2 brooms, 58c.	83
21 boxes concentratad lye	2 20
1 set brasses $4; 5¼ lbs sheet beass $2 15.	6 15
Gas pipe, fittings and air cocks	7 02
18 gallons kerosene oil	3 33
4 doz. lamp wicks 22; 44 chimnies $3 96.	4 18
12 balls wicking 25c; 61 boxes matches $2 12	2 37
7 lbs. blank nuts	49
	$109 29

The cost of each water meter set has been as follows

3 inch	meter on	Wm. Peter mill pipe	$	132 25
3	"	N. B. Bradley & Sons' mill pipe		132 90
4	"	Hamilton & McGregor mill pipe		232 91
4	"	F. E. Bradley & Co mill pipe		238 32
3	"	Eddy. Avery & Eddy mill pipe		132 75
3	"	Eddy, Avery & Eddy pipe to dock		126 25
2	"	Hay, Butman & Co. mill pipe		78 08
1½	"	N. B. Bradley & Sons' drill house		62 04
2	"	S. McLean, Son &Co. mill pipe		76 37
4	"	Folsom & Arnold mill pipe		270 50
3	"	Eddy Bros. mill pipe		156 29
3	"	Dolson, Chapin & Co. mill pipe		164 54
1½	"	T. Riley Denison pipe to dock		48 66
2	"	Dolson, Chapin & Co. drill house		105 61
4	"	Pitts & Cranage mill pipe		243 21
3	"	Pitts & Cranage salt block		132 27
3	"	Pitts & Cranage planing mill		127 18
3	"	Folson & Arnold's drill house		155 32
3	"	McEwan Bro's mill pipe		159 55
1½	"	Mitchell & Boutell's pipe to dock		55 23
1½	"	N. B. Bradley & Sons' drill house		56 26
3	"	A. Rust & Bros. mill pipe		154 81
1	"	A. Rust & Bros, salt block		40 30
3	"	S. G. M. Gates' mill pipe		126 35
8	"	Birdsall & Barker's supply		952 17
1	"	S. McLean Son & Co.'s drill house		30 05
3	"	Briscoe & Hall's mill pipe		125 17
¾	"	Ford's machine shop		33 35
Stock on hand paid for				199 94
				$4,554 63

TWELFTH

Annual Report

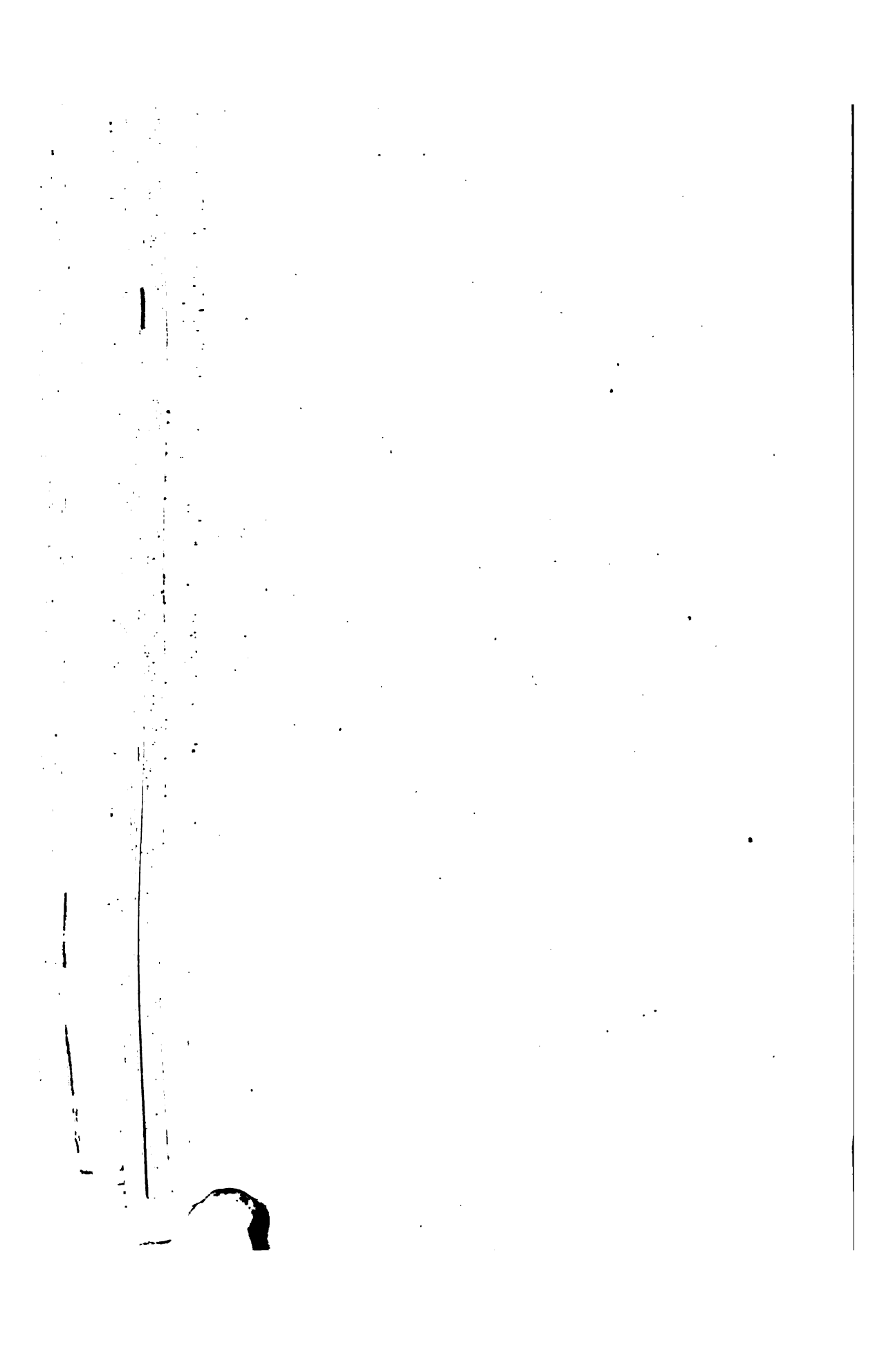
—OF THE—

Superintendent of Water Works

Bay City, Michigan,

For 1883.

BAY CITY, MICH.:
TRIBUNE JOB ROOMS.
1884.



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Board of Water Works.

JANUARY 1, 1884.

First Ward,	Andrew Walton.
Second Ward,	G. Henry Shearer.
Third Ward,	B. F. Ray.
Fourth Ward,	Wm. Smalley.
Fifth Ward,	Chas. E. Young.
Sixth Ward,	Duncan McGregor.
Seventh Ward,	Geo. C. Meyers.

OFFICERS.

President,	Andrew Walton.
Sup't and Sec'y,	E. L. Dunbar.
First Engineer,	A. B. Verity.
Second Engineer,	Fred. H. Holly.

MEMBERS OF

BOARD OF WATER WORKS

SINCE DATE OF ORGANIZATION.

FIRST WARD.

HAEL DAILY, appointed Sept. 6th, 1871, resigned May 13th, 1872.
DREW WALTON, appointed May 27th, 1872; re-appointed Dec. 9th, 1872; Feb. 4th, 1878; and Jan. 22d, 1883; term expires Sept. 6th, 1887.

SECOND WARD.

ES SHEARER, appointed Sept. 6th, 1871; term expired Sept. 6th, 1873.
OMAS CRANAGE, Jr., appointed Nov. 3d, 1873; re-appointed Sept. 2d, 1878; term expired Sept. 6th, 1883.
ENRY SHEARER, appointed Sept. 17th, 1883; term expires Sept. 6th, 1888.

THIRD WARD.

. WESTOVER, appointed Sept. 6th, 1871; re-appointed March 29th, 1875; and Oct. 20th, 1879; resigned Sept. 4th, 1883.
. RAY, appointed Sept. 17th, 1883; term expires Sept. 6th, 1884.

FOURTH WARD.

N McDOWELL, appointed Sept. 6th, 1871; died May 11th, 1872.
. SMALLEY, appointed May 27th, 1872; re-appointed Feb. 4th, 1878; and Dec. 13th, 1880; term expires Sept. 6th, 1885.

FIFTH WARD.

NRY M. BRADLEY, appointed Sept. 6th, 1871; re-appointed Feb. 4th, 1878; resigned May 3d, 1880.
AS. E. YOUNG, appointed June 1st, 1880; re-appointed Sept. 5th, 1881; term expires Sept. 6th, 1886.

SIXTH WARD.

DREW J. MILLER, appointed Aug. 4th, 1873; term expired Aug. 4, 1874.
. CLARKE, appointed Oct. 13th, 1874; term expired Aug. 4th, 1879.
I. DAGLISH, appointed Oct. 20th, 1879; resigned Oct. 24th, 1881.
NCAN McGREGOR, appointed Oct. 31st, 1881; term expires Aug. 4th, 1884.

SEVENTH WARD.

OS. H. McGRAW, appointed Aug. 4th, 1873; resigned Sept. 14th, 1874.
C. McCLURE, appointed Sept. 21st, 1874; re-appointed Nov. 8th, 1875; re signed March 24th, 1879.
O. C. MEYERS, appointed May 5th, 1879; re-appointed Dec. 13th, 1880; term expires Aug. 4th, 1885.



To the Hon. the Board of Water Commissioners of Bay City:

Gentlemen—In compliance with the regulations of the Board, I have the honor to submit my Twelfth Annual Report, showing the operations of the Water Works during the year 1883.

Bay Inlet.

By reason of extreme high water and the almost continuous heavy northerly winds which have prevailed during the past season, it has been impossible to maintain the works at the bay in very good condition. The piles and sheet piling in the break-waters built in 1876, have become decayed to such an extent that heavy logs striking against them with a heavy sea running, caused several breaks, and in September an unusually severe storm caused a break at a point where the bank of the reservoir was not heavy enough to withstand the sea, making a serious break in the reservoir bank, roiling the water in the reservoir, and carrying a considerable quantity of earth from the bank into the reservoir, depositing it immediately in front of the effluent pipe. The same storm filled the inlet cut from the reservoir to the open bay with drift-wood and debris. The work of repairing the damage was commenced at once. A new line of breakwater was driven outside of the old one, around the most exposed portion of the reservoir, and the material is now being procured to complete the renewal on both sides of the inlet cut, as far out as I consider it necessary to maintain them. The deposit in front of the effluent pipe from reservoir has become so great as to seriously interfere with the supply of water to the city; it will be necessary to clean the reservoir in front of this pipe as early as possible in the spring, and the whole reservoir SHOULD be thoroughly cleaned out and the inner slopes timbered or paved.

The pipe leading from the reservoir to the pumping station is in good condition; no repairs have been required on it since it was laid.

Pumping Machinery.

The pumping machinery has been improved by separating the dis-
e of the rotary pumps from the discharge of the piston pumps to
tate repairs and to obviate the necessity for shutting off the pres-
from the pipes throughout the city whenever it is necessary to do
ing to the discharge of any of the pumps.

The machinery has met all the requirements of the water service
g the year in a satisfactory manner, having been always ready to
nd promptly to every demand for fire pressure, and to maintain
ame as was required. That the machinery has been able to do this
e to the more than ordinary care which has been taken of it by the
neers in charge, and their skill and promptness in cases of emer-
y.

Two quite serious breaks in the machinery (which, fortunately, did
ccur at a time when disastrous results could follow) have convinced
hat eleven years of constant and severe service have placed the
ping engines now in use in such condition that they cannot be re-
upon with certainty for the important service required of them.
consideration, together with the fact that the water supply, which
more than ample for our city in 1872, when the pumps now in use
nenced operations, and when the city numbered a population not
eding 10,000, is hardly sufficient for a present population of not
han 25,000, leads me to believe that the time has arrived for the
ase of a new and larger set of pumping machinery.

I had an opportunity in December to examine a number of pump-
engines in actual service, and I believe that the horizontal duplex
ound pumping engine is to-day the most economical engine to
hase, prime cost and cost of running being taken into considera-

As some changes will be necessary in the engine room before a
set of machinery can be placed in position, the extent of which
ot be determined until the style of engine to be adopted and its
oximate dimensions fixed, I recommend that steps be taken imme-
ly for the purchase of a set of pumping engines of not less than
0,000 gallons daily capacity. There is now a balance in the
er Works Fund of about $12,000; this, with the revenue for the

present year, would nearly pay for a new set of pumping machinery if no other extensions or improvements were attempted, but I believe it would be better to pay for the machinery in three or four annual payments, and not stop the extension of the distributing mains and other improvements which the growth of the city demands.

Distributing Mains.

The main pipes in the city have been extended during the year as follows:

A six inch pipe has been laid on Sherman street from Thirteenth to Nineteenth streets, with fire hydrants at the intersection of Fifteenth, Seventeenth and Nineteenth streets, at a cost of $1,463.40.

A six inch pipe has been laid on Fitzhugh street, from Thirteenth to Fifteenth streets, with fire hydrants at Fourteenth and Fifteenth streets, at a cost of $580.70.

The six-inch pipe on Belinda street has been taken up from Water street south to the corner of Woodside avenue and Johnson street, and ten-inch pipe laid in its place; the hydrants along the line were replaced in their old position, and all service pipes connected with the new main without cost to consumers, at a cost of $2,264.46.

The six-inch pipe on Water street, north of First street and on the north line of the Plat of Lower Saginaw, from Water street to Saginaw street, has been taken up, and this pipe, together with the pipe taken up on Belinda street, has been tested, new thimbles put in, and relaid on South Center street, from Broadway to Michigan avenue, with fire hydrants at the F. & P. M. depot grounds, Bowery and Fitzhugh streets and Michigan avenue. The cost of taking up, testing, putting in new thimbles, and laying the pipe on South Center street, including cost of valves and hydrants, was $638.93. The pipe taken up was Wyckoff patent pipe, which had been laid ten years. Of the 2,153 feet of this pipe taken up, all but about 150 feet was, to all appearances, in as good condition as when first laid, and was re-laid on South Center street, as above noted.

A Mathews patent hydrant, with attachments for filling street sprinkler cart, was set on the north side of Center street at the alley between Adams and Jefferson street, at a cost of $128.18; and the four

Wyckoff pipes leading to hydrants at the corner of Twenty-third Stanton streets and the corner of Twenty-third and Marsac streets been extended on account of the widening of Twenty-third street cost of $24.61.

Total of pipe taken up during the year:

	Feet.	
10-in. iron reducer	3½	
6-in. iron branches	27	
6-in. Wyckoff	2,153	
4-in. Wyckoff	56¼	
		2,239¾ ft.

Total of pipe laid during the year:

	Feet.	
10-in. iron pipe and branches	33¼	
6-in. iron branches	34	
4-in. iron elbow	1	
10-in. Wyckoff	1,717½	
6-in. Wyckoff	4,781¾	
4-in. Wyckoff	206¾	
		6,774¼ ft.

Increase in length of distributing mains:

	Feet.	
10-in. iron	29¾	
6-in. iron	7	
4-in. iron	1	
10-in. Wyckoff	1,717½	
6-in. Wyckoff	2,628¾	
4-in. Wyckoff	150½	
		4,534½ ft.

New valves set:

10-inch	1	
6-inch	3	
4-inch	10	
		14
Fire hydrants set	10	

Total length of main pipes connected with the works:

	Miles.	Feet.
30-in. stave pipe from the bay	4	66
18-in. stave pipe irom the river		386
Total of stave pipe	4	452

Distributing mains:

	16-in.	12-in.	10-in.	8-in.	6-in.	4-in.	3-in	Total.
....	1,410	4,883	8,458½	1,938¼	968¼	665½		18,323¼
toff			8,128½	13,208½	51,782¼	19,125	319	92,563¾
otals	1,410	4,883	16,586¾	15,146¾	52,750½	19,790½	319	110,886½

	Miles.	Feet.
Total iron mains	3	2,483¼
Total Wyckoff mains	17	2,803¼
Total	21	6½

Whole number of valves:

30-inch at bay	1
18-inch at river	1
16-inch	1
12-inch	4
10-inch	11
8-inch	27
6-inch	75
4-inch	174
3-inch	3
	— 297

Whole number of fire hydrants:

Holly	108
Matthews	41
Brown	1
	— 150

All double discharge post hydrants.

The ten inch pipe put in on Belinda street, from Water street to the north end of Johnson street, should be extended along Johnson street to Center street, and a six-inch pipe laid on the north side of Center street to connect said pipe with the one at the intersection of Center and Sheridan streets; this will materially increase the water pressure throughout the city, and will be necessary before any material benefit can be derived in the way of increased facilities for fighting fires from a new set of pumping machinery; it should be done as soon as the frost is out of the ground in the spring.

Water Meters.

The year's experience has continued to demonstrate the fact that the meter system is effective in restraining waste, and I believe it to be the only practical method of controlling it and equalizing payments on the basis of quantity of water used. Notwithstanding an increase of nearly ten per cent. in the number of consumers, and an increase of about $1,000 in the water rates, the quantity of water pumped was about 1,700,000 gallons less than in 1882. The first half of the year showed a reduction of nearly 18,000,000 gallons from the first half of

, but the last half of the year showed an increase of about 16,000,- gallons over the last half of 1882. This was due to some extent to ncreased pressure in the residence portion of the city, caused by g a ten-inch main on Belinda street in place of the six-inch, caus- n increased waste of water through open faucets, water closets,

I have heretofore been opposed to placing meters on service pipes sidences, but I now think it will be advisable to extend the meter m so as to include all such residences as have water closets and fixtures where water can be permitted to flow constantly without cting attention; all services larger than two inch are now metered, I hope to be able to so extend the system during the present year embrace all services larger than one-inch, and some of the smaller where the abuses of the water privilege are the most flagrant.

Number of meters attached during the year, 10; of the following and kinds:

Size.....	4-in.	3-in.	2-in.	1½-in.	1-in.	¾-in.	Total.
Rotary.....	1	4	1	1	1	1	9
Crown.....					1		1
Total	1	4	1	1	2	1	10

And one elevator indicator.

One 1½-in. rotary meter has been taken out, the use of water hav- been abandoned on the premises supplied, leaving whole number eters now in use thirty-seven:

Size	8-in.	4-in.	3-in.	2-in.	1½-in.	1-in.	¾-in.	Total.
Rotary.. ...	1	5	17	4	4	3	1	35
Crown						1	1	2
Total.....	1	5	17	4	4	4	2	37

And one elevator indicator.

We have on hand one 3-inch meter, one 2-inch meter, and one ch meter.

Service Stop Boxes.

The wooden stop boxes in use are a source of much annoyance and iderable expense; very few of them have covers, and many of them

have decayed to such an extent that they cannot be found, and in case it becomes necessary to shut off the water, it is frequently the work of hours, where a few minutes should be sufficient. I believe it to be in the interest of consumers, as well as of the city, to require iron stop boxes on all new services, and on old ones, as fast as the old boxes become unserviceable.

Cast iron extension stop boxes made by Bingham & Morgan, of Buffalo, have been kept in stock since 1878; they are sold to consumers at a price which just covers the cost and handling, but only about 50 have been put in. The use of stop boxes of some more indestructable material than wood is required in nearly every city having a public water supply, and I think the Bingham & Morgan stop box is as good and as cheap as any device, for the purpose, which has been called to my attention, and I recommend its adoption.

Service Connections.

There have been 110 service taps and one branch service connected with the mains during the year, and 17 have been taken out with main pipes removed, making increase in service connections for the year 94. The connections made are as follows:

	4-in	1-in	¾-in	⅝-in	½-in	Total
With iron mains		1	1	3	4	
With Wyckoff mains	1	2	15	41	43	102
Total	1	3	16	44	47	111

Connections taken out:

Size	1-in	¾-in	⅝-in	½-in	Total
Wyckoff mains	1	5	3	8	17

Whole number of service connections to date:

Size	2-in	1 ¼-in	1-in	¾-in	⅝-in	½-in	⅜-in	Total
Iron mains	2	6	42	49	29	72	5	205
Wyckoff mains	13		108	367	87	347		922
Total	15	6	150	416	116	419	5	1127

Branches:

Size	8-in	6-in	4-in	2-in	Total
Number	1	4	18	1	24

Twenty-eight service connections are shut off at the main pipe, ng been abandoned and new services put in for supplying the same ises. One branch service has no pipe connected with it, the ch being plugged.

MAINTENANCE.

The expense of operating the works has been more than for 1882, principal increase being for office expenses, superintendent's salary, repairs at Bay. The increase in office expenses has been occa ed by the employment of a collector, which has been found neces- during the entire year. Even with one person devoting his entire to the collections, a record showing nearly $1,000 outstanding at end of the year, is far from satisfactory, and when the list of delin- nts is examined it will be seen that nearly the whole amount is due parties who would feel themselves grossly insulted if the water ld be shut off and the account placed in the hands of the city attor- for collection, as the plain letter of the ordinance requires.

With the commencement of the present year I have adopted the of requiring EVERY ONE to pay their rates at the office. I do not ect this will result in much, if any, saving of expense, but with the loyment of the same assistance, the office can be kept open all of time during business hours, which it has been impossible to do here- re, and no person can offer as an excuse for their rates not being , that they had been to the office several times to pay, and found it ed.

I propose also to give every one a reasonable time in which to pay r rates,and then if unpaid to shut them off without reference to who are; this has already been commenced on those who are delinquent ast year's rates and with very salutary effect—most of those shut off ng liquidated.

The salary of the superintendent and secretary was increased from 00 to $1,800 per annum on the first day of April, which accounts $225 of the increase in operating expenses.

The cost of repairs to the distribution system has been less than for

1882, on account of less expensive changes having been required in the lines of water pipe to make way for sewers and other public improvements.

There have been no leaks discovered in the iron mains during the year. Sixteen leaks have been discovered in the Wyckoff mains, fourteen of which were leaks in joints, readily repaired by calking; two were defective pipe and had to be taken out and new pipe inserted; the total cost of these repairs, including new pipe where required, was $63.63.

The main pipes have been raised at three points to make way for new sewers where they intersected their line at grade. Three hydrants have been changed to make way for pavements and sidewalks where required by the widening of streets or other causes, and one hydrant has been raised to conform to the grade of the street where the same has been paved.

The extreme weather during the winter of 1882–83 caused a large amount of extra work to keep the fire hydrants in working order. Between January 1st and April 1st sixty-nine hydrants were found frozen to such an extent as would have delayed the firemen in getting water had they had occasion to use them. But so constantly were they watched that no more than four hydrants in the entire city were not serviceable at the same time. With seventeen fires and fifteen hydrants used, but one was found frozen by the firemen when its use was required, and this one had been left all right by an employe of the water works less than twenty-four hours before it was found frozen by the firemen. Fortunately no additional loss of property accrued from the delay.

Several of the water meters have required cleaning during the year; they having become choked with iron rust or sediment and failed to register. These are all of the repairs that have been required on the meters during the year, and have cost $13.23.

The reason of the increased cost of repairs at the bay has been given in the first part of this report.

The total amount paid for operating expenses, aside from pumping, has been as follows:

For office expenses	$ 752.13
Superintendent and secretary's salary	1,725.00
Repairs and care of hydrants, valves, pipes, etc	624.56
Repairs to buildings	22.63
Repairs to breakwater at bay	942.39
Repairs to water meters	13.23
Implement account	94.80
Total	$4,174.74

Pumping Expenses.

The cost of running the pumping engines has been less than for . Much care has been taken to keep the boilers in good condition, free from scale, and there has been a consequent reduction in the tity of fuel burned. The services of the extra fireman for service ng fires has been dispensed with; the wood having been delivered e fire room by teams, instead of having been taken from the yard ie firemen.

The cost of oil, packing, etc., has been considerably increased over , by reason, mainly, of the quantity of material used in keeping boilers free from scale; this money has, however, been judiciously nded and the result has been very satisfactory. The expense for icating oils has also been greater than for the previous year, the ity of oil received not having been satisfactory.

A larger amount has been paid for repairs to pumping machinery for previous years on account of renewing one of the main piston ps, the casting for which was in the shop being fitted up when my annual report was made. The castings for two more of these ps are now being fitted up and will soon be ready to be placed in tion.

Amount paid for running pumping engines during the year:

For engineer's and firemen's wages	$3,480.00
Fuel	3,201.50
Oil, packing and engineer's supplies	492.37
Repairs to pumping machinery	377.78
Total	$7,551.65

Water Pumped.

Total quantity of water pumped during the year, as indicated by the revolutions of the pumps, 773,942,702 gallons, of which 765,343,666 gallons were pumped at the ordinary domestic pressure of 40 lbs. to the square inch, at the level of the pressure gauge in the engine house, which is equivalent to a lift of 107 feet from the level of the water in the wells; and 8,599,036 gallons were pumped against a fire pressure averaging 70 lbs. per square inch, at the level of the pressure gauge, which is equivalent to a lift of 170 feet from the level of the water in the wells.

The actual net cost of running the pumping engines was $7,558.24, as follows:

For fuel consumed	$3,187.67
Oil, packing, etc., used	512.79
Repairs to pumping machinery	377.78
Engineer's and firemen's wages	3,480.00
Total	$7,558.24

Making cost per million gallons pumped	$ 9.77
Cost per million gallons raised 100 feet	9.07
Cost of fuel per million gallons pumped	4.12
Cost of fuel per million gallons raised 100 feet	3.82

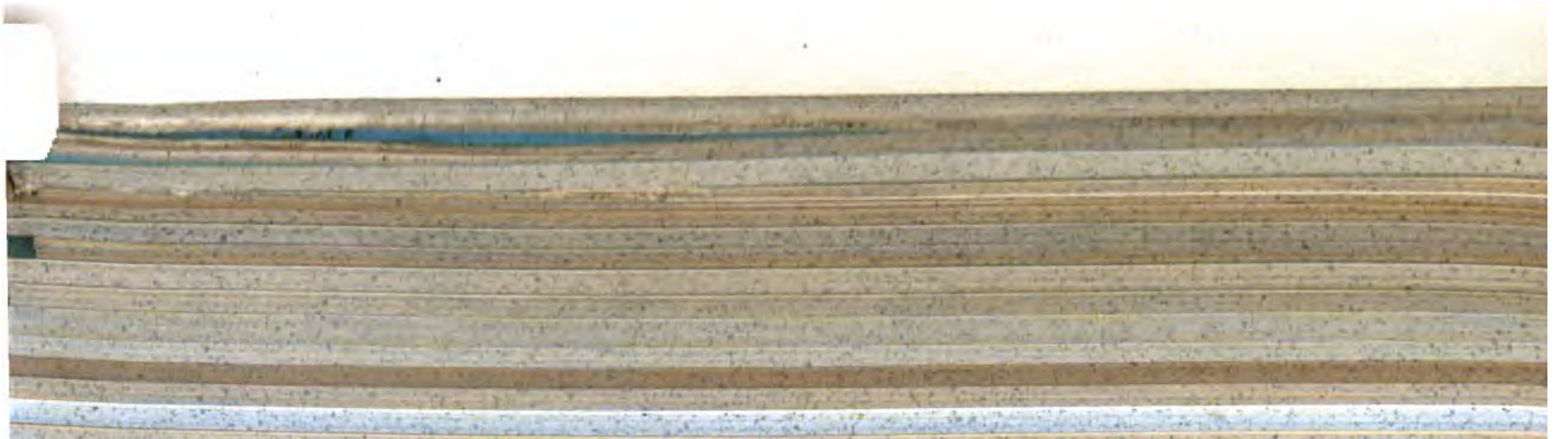
Which shows a little less than for the year 1882.

The following table shows by months the quantity of water pumped by piston pumps, also by the rotaries, and total, with number of fire alarms, hours run for fires, and gallons of water pumped at fire pressure:

MONTH.	PISTON PUMPS. Hours Run.	Revolutions.	Gallons Pumped	ROTARY PUMPS. Hours Run	Revolut'ns	Gallons P'mp'd	Gallons Pumped	Daily Av'r'ge	No of Al'm.	Hours Run	Highest Press're	Lowest Press're	Average Press're	Gallons pump'd
January	739.05	1,226,188	63,040,016	3.25	16,056	321,120	63,361,136	2,043,907	13	7.27	70	60	66	890,202
February	666.52	* 1,197,886	60,196,513	9.18	37,856	757,120	60,953,633	2,176,915	2	12.13	60	50	53	1,422,668
March	738.33	* 1,355,504	64,655,676	8.17	37,300	746 000	65,401,676	2,109,731	2	1 20	60	60	60	161,962
April	716.10	* 1,113,201	58,935,147	3.50	18,604	372,080	59,307,227	1,976,908	4	1.45	70	70	70	199,704
May	742.23	1,072,729	56,854,637	1.37	7,783	155,660	57,010,297	1,839,042	1	38	70	70	70	62,858
June	716.24	1,083,170	57,408,010	11.06	44,765	895.300	58,303,310	1,943,444	11	10.24	90	60	62	1,749,150
July	743.09	* 1,228,227	64,779,169	1.38	8,506	170,120	64,949,289	2,095.138	2	1.22	90	65	77	214,601
August	742.30	1,323,803	70,161,559	5.51	30,176	603,520	70,161,559	2,282,744	5	8.15	90	70	81	1,324,018
September	719.30	1,294,859	68,627,527	5.02	19,513	390,260	69,017,787	2,300,593	8	6.34	100	75	82	1,079,586
October	743.09	* 1,304,101	68,539,516	1.04	6,882	137,640	68,677,156	2,215,392	8	4.31	80	40	73	589,705
November	714.11	* 1,260,350	65,170,809	6.01	31,271	625,420	65,796,229	2,193,207	6	3.46	80	70	75	481,929
December	742.52	1,324,291	70,187,123	2.08	10,623	212,460	70,399,883	2,270,964	7	2.57	80	60	75	422,363
Totals	8,724.38	14,784,309	768,556,002	59.17	269,335	5,386,700	773,942,702	2,120,390	69	61.12	100	40	70	8,599,036

*February, 6,123 revolutions, 2 pumps
" 140,703 revolutions, 3 pumps
*March, 4714 revolutions, 2 pumps
" 504,197 revolutions, 3 pumps.
*April, 4962 revolutions, 3 pumps
*July, 22,633 revolutions, 3 pumps
*October, 44,449 revolutions, 3 pumps
*November, 97,423 revolutions, 3 pumps

After March 9th the four piston pumps had a capacity of 53 gallons per revolution; the left back pump having a capacity of 14 gallons per double stroke, instead of 13 as before.



The following table shows the total quantity of water pumped each year since the works commenced operations :

1873	142,477,725 gallons	1879	672,344,128 gallons
1874	294,714,798 gallons	1880	827,067,372 gallons
1875	416,756,579 gallons	1881	944,382,043 gallons
1876	518,197,129 gallons	1882	775,642,466 gallons
1877	538,847,186 gallons	1883	773,942,702 gallons
1878	580,197,397 gallons		

Receipts.

The receipts of the office have not been quite as much as was anticipated at the commencement of the year, but they still show a healthy increase over the previous year. The total receipts of the office for the year were $18,750.19, of which $18,386.32 was from water rates. The total receipts for the year show an increase over the previous year of $839.48, and the receipts from water rates show an increase of $1,003.64.

Of the amount collected from water rates, $509.00 was from delinquent rates on rolls previous to 1883, leaving $17,877.32 as the amount collected from rates of 1883; of this amount, $3,920.74 was for metered water, and $13,956.58 from assessment rates. The amount uncollected at the close of the year (on roll of 1883) was $931.78, of which $375.03 was for metered water, and $556.75 for assessment rates, making total amount charged on roll for assessment rates $14,513.33, and total for metered water $4,295.77.

The quantity of water furnished through meters during the year was 56,080,827 gallons, which returned a revenue of about 7⅞ cents per 1,000 gallons.

The whole quantity of water delivered into the city as indicated by the strokes of the pumps was 773,942,702 gallons; deducting 10 per cent. as a proper allowance for slip in pumps, etc., would leave 696,548,432 gallons as the actual quantity of water delivered into the city. Assuming that 25 per cent. of this is used for public purposes, fire department use, flushing sewers, flushing pipes, supplying public watering troughs, etc., (which I believe to be a reasonable allowance as

r is used in this city,) leaves quantity of water furnished to con-
ers 522,411,324 gallons, or 466,330,497 gallons to those consumers
paid for water at assessment rates; this water returned a revenue,
l collected) of $14.513.33, or about 3⅛ cents per 1,000 gallons.

The following shows in detail all receipts from all sources during
ear:

From water rates roll of 1877	$ 5.00
From water rates roll of 1878	8.75
From water rates roll of 1879	6.87
From water rates roll of 1880	13.17
From water rates roll of 1881	41.25
From water rates roll of 1882	433.96
From water rates roll of 1883	17,877.32
From plumber's licenses	25.00
From sale of scrap leather	3.87
From labor on repairs	3.00
From sale of service taps	312.65
From sale of service stop boxes	19.35
Total receipts	$18,750.19

This amount has been deposited with the city treasurer as per re-
ts on file, as follows:

January 31	$1,654.04	July 31	$2,433.13
February 21	1,421.12	August 31	1,127.01
March 31	983.97	September 29	829.47
April 30	2,702.72	October 31	3,127.92
May 31	956.81	November 30	1,335.87
June 30	894.61	December 31	1,283.52

And by him placed to the credit of the water works fund.

There has been withdrawn from the water works fund by requisi-
on the Recorder $18,150.00, and the same has been deposited with
treasurer of the board, as follows:

January 30	900.00	July 30	$3,000.00
February 27	1,200.00	August 30	1,500.00
March 30	900.00	September 28	1,500.00
April 28	2,000.00	October 30	1,500.00
May 31	1,000.00	November 28	1,250.00
June 29	2,500.00	December 31	900.00

The receipts for which are on file. This leaves a balance in the
er works fund, at the close of the year, of $12,393.46, an increase of
0.19 over the balance in the fund January 1st, 1883.

DISBURSEMENTS.

The following statement shows in detail the expenditures for all purposes during the year:

For office expenses:

Paid collector	$382 50
Accountants examining books	24.62
Printing report for 1882	20.00
Rent of telephone	40.00
Blank books, printing, etc	49.75
Receipt books	19.50
Stationery, ink, etc	4.75
Letter box, coal, repairs, etc	11.01
Total	$752.13

For Superintendent and Secretary's salary:

Paid Superintendent's salary, from January 1 to April 1, at $1,500 per year	$ 375.00
Superintendent's salary from April 1 to December 31, at $1,800 per year	1,350.00
Total	$1,725.00

For repair and care of hydrants, valves and pipes:

Paid labor repairing 16 leaks in Wyckoff pipe	$ 54.50
Pipe for same	9.13
Labor raising pipe at three sewer crossings	21.25
Pipe for same	5.73
Labor moving hydrants for walks and pavements	9.00
Labor examining and thawing hydrants, turning on and shutting off water, etc	456.34
For two hydrant cases, freight and cartage	12.10
Machine work repairing hydrants and valves	54.90
Leather for hydrant valves	2.61
Total	$624.56

Repairs to break-water at bay:

Paid labor refilling reservoir banks	$ 9.50
Labor redriving sheet-piling	50.50
Plank, spike and bolts for repairs	136.92
For new piles and towing same	116.10
For driving 89 piles	178.00
For clearing away old work	25.00
For 14,331 ft. of plank for new work and freight	273.12
For spike for new work	32.05
For labor driving 680 ft. of sheet-piling, and cutting off, lining up, and planking piles	121.20
Total	$ 942.39

Repairs to water meters:

Paid for labor cleaning five meters and removing one	$ 13.23

Repairs to engine house:

Paid for white washing engine room	$ 9.50
For material and brushes for same	1.30
For flooring for engine room	6.75
For nails, etc	2.45
For repairing conductors	2.63
Total	$22.63

Implement account:

Paid for small tools for engine house	$19.42
For small tools for street work	17.20
For small boiler for thawing hydrants	46.30
For repairing tools	11.88
Total	$94.80

Engineer's and firemen's wages:

Paid First engineer's salary	$1,200.00
Second engineer's salary	960.00
Two firemen	1,320.00
Total	$3,480.00

Fuel account:

Paid Dolsen, Chapin & Co., for 3,370 cords of slabs and edgings, at 70c	$2,359.00
For hauling the same	842.50
Total	$3,201.50

Oil, packing and engineer's supplies:

Paid for lubricating oils	$119.93
For engine and pump packing	53.88
For leather, bolts, and rivets for pumps	38.56
For cleaning material, wipers, etc	60.25
For lye, potash, soda, etc., for boilers	129.51
For red lead, gauge glass, etc	7.51
For kerosene oil, chimneys, etc	64.73
For ice for season of 1883	18.00
Total	$ 492.37

Repairs to pumping machinery:

Paid for repairs to discharge main	$ 47.08
For fitting up new pump	197.18
For repairs to pony pump	27.08
For repairs to feed pumps	5.54
For repairing broken connection rod	10.82
For repairing gear on rotary pump	4.32
For repairing counter	10.05
For repairs to exhaust pipe	10.00
For repairs to boilers	9.75
For new grate bars	16.09
For paint for engines	5 23
For bolts, nuts, etc	1.65
For valves, pipe, fittings, etc	32.99
Total	$ 377.78

Service connections:

Paid for labor inserting taps	$ 58.00
For corp. stops: 6 doz. ½-in., 3 doz. ⅝-in., and 1 doz. ¾-in	84.60
For freight and cartage	1.20
Total	$143.80

Service stop boxes:

Paid for 25 stop boxes	$38.75
For cartage	30
Total	$ 39.05

Water meters:

Paid for one 1-inch Crown meter	$ 32.25
For one ¾-inch Crown meter	23.25
For five 3-inch Union meters and freight	522.50
For one 4-inch Union meter and freight	207.34
For one elevator indicator	30.00
For 8 meter boxes, labor and material	31.02
For one pair 4-inch meter connections	7.00
For two pair 3-inch meter connections	9.48
For labor and material for setting eight meters and one elevator indicator	95.13
Total	$ 957.97

Pumping machinery:

Paid for new discharge to rotary pump	$253.14
For separating discharge of piston pumps	13.59
For counter for rotary pumps	10.00
Total	$276.73

Iron pipe:

Paid for three 6x4 inch tees on Sherman street	$ 20.21
For eight 10-inch branches, and one 10-inch elbow on Belinda street	143.00
For two 10-inch branches on Woodside Avenue	30.18
For one 4-inch bend on Stanton street	3.24
For one 6-inch branch on Fitzhugh street	8.40
Total	$205.03

Wyckoff pipe:

Paid for pipe to hydrant on Center street	$ 7.06
For new pipe on South Center street	1.36
For pipe laid on Sherman street	1,061.76
For pipe laid on Twenty-third and Stanton	6.62
For pipe laid on Twenty-third and Marsac	6.25
For pipe laid on Belinda street	1,648.45
For pipe laid on Woodside avenue	75.96
For pipe laid on Johnson street	30.15
For pipe laid on Fitzhugh street	369.21
Total	$3,206.82

Valves for street main:

Paid for valves and cases for South Center street	$ 52.54
For valves and cases for Sherman street	65.14
For valve and case for Center street	14.50
For valve and case for Johnson street	49.90
For valves and cases for Fitzhugh street	50.73
Total	$232.46

Public fire hydrants:

Paid for hydrant on Center street, freight, etc	$ 96.04
For three hydrants for Sherman street	92.79
For four hydrants for South Center street	127.65
For two hydrants for Fitzhugh street	62.86
Total	$379.34

Laying pipe:

Paid for labor laying pipe on Center street	$ 10.93
For labor laying pipe on Twenty-third street	8.50
For labor laying pipe on Sherman street	223.50
For labor laying pipe on Belinda street	242.17
For labor laying pipe on Woodside avenue	40.55
For labor laying pipe on Johnson street	4.10
For labor laying pipe on Fitzhugh street	89.50
For labor taking up pipe on Water street and on north line plat of Lower Saginaw	63.09
For hauling, testing, and thimbling old pipe	162.52
For labor laying pipe on South Center street	231.77
Total	$1,076.63

Water Rates for 1884.

The regular assessment roll of water rates for the year 1884, amounts to $14,772.00, an apparent increase over the footing of the roll of 1883, on the first day of January, 1883, of $535.00, but it is, in reality, an increase of $1,025.00; as $490.00 of assessment rates of 1883 are now supplied through meters, and do not appear in the assessment roll for 1884.

Assuming that the receipts for metered water will equal the receipts from that source for 1883 — and I see no reason why they should not — with the usual increase in consumers, the receipts of the works from water rates for the year 1884, will reach full $20,000.00.

The following table shows the amount collected and total amount charged for water on each year's roll, (including metered water) since the works commenced operations.

Year.	Amount collected.	Uncollected	Total of Roll
1873, January 1 to April 30	$ 728.82		$ 728.82
1873-4, May 1 to April 30	5,440.80	$ 1.60	5,442.40
1874-5, May 1 to April 30	6,908.16	44.85	6,953.01
1875, May 1 to December 31	7,269.55	28.46	7,298.01
1876	9,571.26	82.73	9,653.99
1877	9,604.26	134.19	9,738.45
1878	10,078.15	324.71	10,402.86
1879	11,708.97	136.07	11,845.04
1880	13,140.49	140.50	13,280.99
1881	14,962.61	262.40	15,225.01
1882	17,312.35	207.97	17,520.32
1883	17,877.39	931.78	18,809.17
Total	$124,602.74	$2,295.26	$126,898.00

The following balance sheet shows the ledger balances at the se of the year 1883:

LEDGER BALANCES, DR.

482, Real estate	$ 6,724 83	
482, Dock, tramway and store shed	1,892 63	
482, Engine house, chimney, and wells	19,097 42	
483, Engine and boiler foundations and arches	4,931 72	
483, Inlet from Saginaw river	3,218 99	
483, Inlet from Saginaw bay	84,778 37	
484, Reservoir and breakwaters at bay	21,491 78	
484, Filter at bay	1,683 13	
484, Pumping machinery	39,386 37	
485, Iron pipe and branch castings	52,948 39	
485, Wyckoff pipe	72,776 53	
485, Laying pipe	33,857 42	
486, Valves for street mains	8,970 12	
486, Public fire hydrants	7,717 78	
486, Furniture and fixtures	601 92	
487, Implement account on construction	1,713 61	
487, Engineering and general superintendence on construction	7,856 17	
487, Travelling expenses on construction	306 29	
488, Insurance account on construction	29 00	
488, Interest, discounts, and commissions on construction	4,224 17	
489, Service stop boxes	38 55	
489, Water meters	5,512 60	
491, Thos. Ross	15 57	
491, A. L. Stewart	15 00	
490, Water works fund	12,393 46	
490, Orrin Bump, treasurer of board	525 95	
412, Office expense and salary	19,483 56	
416, Repairs and care of hydrants, valves and pipes	6,000 99	
412, Engineer and fireman's wages	38,552 84	
413, Fuel account	29,519 18	
413, Oil, packing, and engineer's supplies	4,527 01	
414, Repairs to pumping machinery	2,350 50	
414, Repairs to boiler arches	540 93	
415, Repairs to engine house and insurance	445 52	
415, Repairs to dock	13 38	
416, Repairs to reservoir and breakwater	1,404 25	
417, Implements on repairs	743 92	
417, Repairs to water meters	28 85	

LEDGER BALANCES, CR.

io 489, Service tap account		1,349 99
411, Plumber's licenses		236 70
411, Rents, dockage, etc		837 83
409, Water rates rolls, 1873-78		49,601 00
409, " " 1879		11,708 97
410, " " 1880		13,140 49
410, " " 1881		14,962 61
418, " " 1882		17,312 35
418, " " 1883		17,877 32
481, Bay City bond account, ($377,000 bonds)		368,045 87
481, Water assessment, frontage on pipe		736 07
	$495,808 70	$495,808 70
al water rate balances		$124,602 74
al construction balances	$379,247 79	
al maintenance balances	$103,610 93	

The usual yearly examination of the books of the office was made after my report for 1882 was published. A copy of the report of the accountants making such examination accompanies this report.

Respectfully submitted,

E. L. DUNBAR,
Superintendent and Secretary.

Bay City, January 25th, 1884.

REPORT OF ACCOUNTANTS.

TO THE HONORABLE BOARD OF WATER COMMISSIONERS OF THE CITY OF BAY CITY:

GENTLEMEN: — We, the undersigned accountants, employed to examine the books and accounts of the Bay City Water Works for the year 1882, would respectfully report as follows:

That we have carefully examined the records, vouchers, accounts and books of the Secretary, and found them correct.

We have also examined all assessment rolls, and have compared the same with the stubs of receipts, and find that they agree with the daily record, also with the day book; and we find the ledger balances correct, as per trial balance of the Secretary, Jan. 1, 1883, in his eleventh annual report, dated Jan. 20th, 1883.

(Signed) DAN'L A. MARSHALL,
(Signed) CHAS. F. BRAMAN,
Accountants.

Bay City, February 19th, 1883.

Thirteenth

Annual Report

—OF THE—

Superintendent of Water Works,

Bay City, - Michigan,

For 1884.

BAY CITY, MICH.:
TRIBUNE BOOK AND JOB ROOMS.
1885.

THIRTEENTH

ANNUAL REPORT

—OF THE—

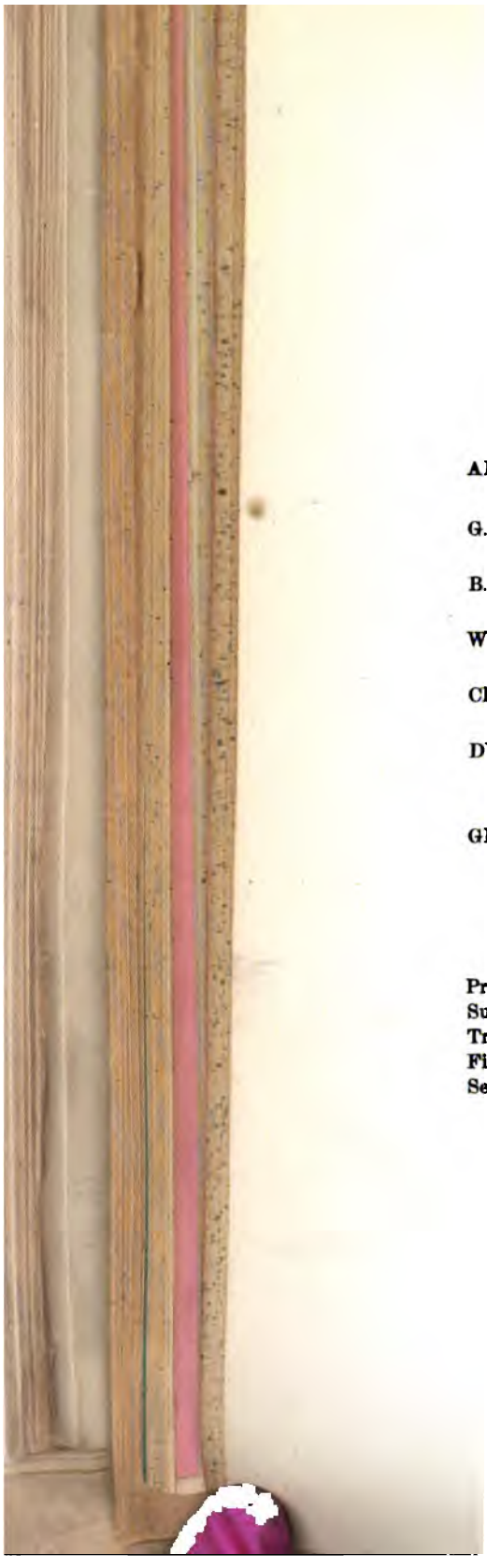
Superintendent of Water Works,

Bay City, Michigan,

FOR 1884.

BAY CITY, MICH.:
TRIBUNE JOB ROOMS.
1885.





Board of Water Works.

JANUARY 1, 1885.

FIRST WARD.

ANDREW WALTON.....Term expires Sept. 6th, 1887.

SECOND WARD.

G. HENRY SHEARER.....Term expires Sept. 6th, 1888.

THIRD WARD.

B. F. RAY.....Term expires Sept. 6th, 1889.

FOURTH WARD.

WM. SMALLEY.....Term expires Sept. 6th, 1885.

FIFTH WARD.

CHAS. E. YOUNG.....Term expires Sept. 6th, 1886.

SIXTH WARD.

DUNCAN McGREGOR.....Term expired Aug. 4th, 1884. (Successor not appointed).

SEVENTH WARD.

GEO. C. MEYERS.....Term expires Aug. 4th, 1885.

OFFICERS.

President.....ANDREW WALTON.
Sup't and Sec'y.....E. L. DUNBAR.
Treasurer.....ORRIN BUMP.
First Engineer.....A. B. VERITY.
Second Engineer.....FRED. H. HOLLY.

THE HON. THE BOARD OF WATER COMMISSIONERS OF BAY CITY:

GENTLEMEN—I have the honor to submit herewith my Thirteenth ual Report, giving a synopsis of what has been done in the Water ks Department during the year 1884.

SOURCE OF SUPPLY.

The true source of supply of the water works of this city having me a disputed question within the past few weeks—the statement ng been made by a prominent scientific gentleman that he had e to the conclusion that Bay City was generally supplied with water Saginaw river, instead of from Saginaw bay, as the people of the have supposed, and as there appears to be a few residents in the who think there is some foundation for the statement—the length me that the city has been to ANY extent supplied with water from inaw river during the year is given: from the statement of Mr. A. B. ity, First Engineer at the pumping station, who has direct charge he valves controlling the admission of water from the river, it ap- s that the river pipe has been opened twelve times during the year, llows:

	Hours.	Min.
January 2nd	3	12
" 7th	3	
" 12th	5	15
April 22nd	2	
" 27th	3	
June 14th and 15th	8	
July 3rd	3	
July 23rd	1	15
October 10th	2	
" 21st	0	10
November 17th and 18th	8	
" 19th	1	18
Total	40	10

The balance of the year the city supply has been taken entirely n Saginaw bay. During the 40 hours and 10 minutes above men- ed, a large portion of the supply came from the bay, except the 11

hours noted on July 3rd and November 17th and 18th. On the 3rd day of July the gate at the bay end of the pipe was broken, and the supply from the bay shut off entirely until means could be devised for opening it ; making it necessary to take the entire supply from the river about three hours. During the evening of November 17th the supply from the bay was shut off by anchor ice and the entire supply was taken from the river from 8 o'clock in the evening until 4 o'clock the following morning.

The necessity for opening the pipe from the river at the other times mentioned is explained as follows : The full capacity of the pipe from the bay is about 5,000,000 gallons in 24 hours, but this quantity can only be delivered when the water in the wells at the pumping station is drawn down to the bottom of the pipe which conveys the water from the bay, and the quantity of water delivered into the wells through this pipe approaches its full capacity in its due ratio to the extent that the level of the water in the wells is drawn down towards this limit. When it becomes necessary to start the rotary pumps by reason of the piston pumps not being capable of supplying the demand, the water level in the wells has to be raised higher than when only the piston pumps are operated ; this is on account of the rotaries having become so much worn that they will not take suction when the water is drawn down very low in the wells. Except on the two occasions when the supply from the bay was entirely shut off, the river pipe has been opened only when it was necessary to run both pistons and rotaries at the same time.

The gentleman making the statement that Bay City was generally supplied with water from Saginaw river, appears to base his conclusions mainly upon the discovery of a larger portion of salt in the water in the city than is contained in the water in the bay. It is possible to explain this excess without supposing the pipe between the bay and the pumping station to turn to salt. This pipe is made from staves from four to six inches wide, banded together in the form of a circular pipe. This pipe passes under one salt works and in close proximity to another. That the waste from these salt works might penetrate the soil to the pipe, and impregnate the water therein to an appreciable extent is not only possible, but quite probable.

In order to determine whether there is any serious contamination of

water supply between the bay and the city, and if so at what point ccurs, and also to determine whether its quality can be improved by expenditure the city can afford, I recommend that a chemical anal- be procured of samples of water taken from the following points:

1st. From Saginaw bay, say two miles or more from the shore.
2d. From Saginaw bay about half a mile beyond the present inlet.
3d. From the inlet basin near the end of the inlet pipe.
4th. From the wells at the pumping station.
5th. From a hydrant in the central portion of the city.
6th. From Saginaw river opposite the pumping station.

Until these analysis are made it will be a useless expenditure of e and money to make estimates for extensions which may or may be in the required direction. That there can be any very marked provement in the quality of the supply from the bay, with any ex- diture within the present reach of this city, while the government k of dredging at the mouth of the river, and dumping the material dged from the bottom of the river into the bay, continues, is not bable. There is a large amount of sediment in this material which s not readily settle to the bottom, and is disseminated through the ters of the bay, several miles from where it is deposited. When the vernment work was discontinued for several weeks last summer, re was very soon noticed a marked decrease in the quantity of sedi- nt carried by the waters in the bay, in the vicinity of the inlet; and re was a corresponding increase in the quantity of sediment soon er this work was resumed in the fall. There is no doubt that this rk has had much to do with the unsatisfactory condition of the water pply of the city during the past two seasons.

Inlet Works at the Bay.

The work of renewing the breakwaters on both sides of the inlet t was commenced in February last and was carried out about 500 et beyond the reservoir, which is as far as it was thought advisable to empt to maintain them at present.

On the 9th day of June occurred the most severe storm from the rtheast that has been experienced on Saginaw bay since the water rks were built. This storm carried away nearly 400 feet of the

breakwaters constructed in 1883 along the north bank of the reservoir, made a broad opening into the reservoir and carried in a large amount of sediment. The opening in the reservoir bank was closed as soon as the storm subsided, and material was gathered at once to repair the breakwater. Before much could be accomplished besides driving the main piles another storm came up almost as severe as the first and nearly obliterated the north bank of the reservoir. The bank was at once repaired sufficiently to prevent the water flowing over it into the reservoir, and the breakwater completed as fast as the weather would permit. As fast as completed they were now backed with stone along the most exposed portion. When the water was too rough for work on the breakwater the men were employed in wheeling dirt from the south bank of the reservoir, where there is a large quantity of superfluous earth, to replace the north bank. At the close of the season the banks were again in fair condition.

The length of new breakwater built during the year was 1,232 feet, of which 470 feet was on the east side of inlet cut, 350 feet on the west side, and 412 feet along the north side of reservoir. Two hundred and two white oak piles were driven, which have been cut off, lined up and planked with three-inch oak plank ; 1,232 lineal feet of sheet piling has been driven—the quantity of oak plank used on the sheet piling and planking being 31,950 feet ; 500 lineal feet of breakwater has been aproned with stone in front to above the surface of the water, and 250 feet has been backed with stone ; 74⅜ cords of stone have been used on this work.

The work of filling in the breakwater with stone should be continued until all are made secure, as whatever course may be pursued in extending the works at the bay, it will be necessary to maintain the inlet basin for use in cases of emergency. The gate at the reservoir which controls the flow to the influent chamber was closed July 3rd for the purpose of cleaning the strainer on the end of the bay pipe. When this work was completed, and the attempt made to open the gate, it was found to be broken in such a manner as to prevent its being opened in the usual manner. It became necessary to drive to the city for tools and assistance, and the gate remained closed about three hours. It is now held open from the timber work above the surface of the water, and cannot well be repaired without pumping out the reservoir.

Manhole No. 1 on the bay pipe is located at the shore. When the
ks were built it was several feet from the water's edge, and above
reach of what was then supposed to be high water ; the high water
he past two seasons has encroached upon the shore at this point until
storm of June 9th destroyed the upper portion of the masonry and
d it with sand. The masonry has been rebuilt and surrounded with
e in a manner which will prevent further injury.

The amount expended on this branch of the works during the year
been $2,429.85, of which the repairs to gate and manhole, $10.40,
renewal of breakwaters, $1,853.95, have been charged to mainten-
e account, and the cost of stone used in filling breakwaters, being a
nanent improvement not included in the former work, and amount-
to $555.50, has been added to construction account.

There has been erected on the shore, upon land owned by the city,
nall three room dwelling, which is completed with the exception of
w small matters, at a cost of $277.80. It is proposed to employ a
in the spring to take charge of the inlet works, keep the banks,
and reservoir in order, and live in this house. As soon as the house
ccupied, telephone connection should be made between there and
city.

Pumping Machinery.

The matter of additional pumping machinery for the works re-
ns in the same position as at the commencement of the year. The
ommendations embraced in my last annual report met with your ap-
val, and proposals were received in March from the Holly Manf'g
and the Geo. F. Blake Manf'g Co. for furnishing a pumping engine,
ed to the requirements of the city ; at a later date a proposal was
eived from E. P. Allis & Co.

As the Board did not think they were authorized by existing or-
ances to make a contract involving the amount of money called for
this improvement, a communication was sent to the City Council on
10th day of March requesting them to so amend the ordinances as
ermit the closing of a contract at once. As the Council were not
ed to appropriate any money for the purchase, proposals having been
eived of such a nature as would permit the payments to be met by

the receipts from water rates, it was thought there would be no opposition in the Council to the legislation requested. Before any action was taken by the Council in the matter the question arose as to the legal right of either Council or Water Board to authorize the expenditure of any of the revenues of the Board for any purpose looking toward an extension or enlargement of the works in any direction. The matter remained without action by the Council until May 26th, when it was referred to the Ordinance Committee, and the Committee on Water Works, where it remained another two months. At the first meeting of the Council in August a lengthy report was presented by the Committees, which report recited at some length the history of the construction of the Water Works, and closed with no recommendation, but a statement that, in the opinion of the committees, a supply of pure water was at the present time a greater necessity than an increase in the pumping power of the works. As no action was taken by the Council on this report, it was accepted as the judgment of the Council that no pumping engines were to be purchased at present. As no objection has been interposed by the Council to the extension of the water mains, it must be inferred that the objection is not based on the fact that the Board have no legal right to expend any portion of the receipts from water rates for the purpose of extending the works; but must be based on the fact that they do not think the pumping engines are required.

That an improvement in the pressure for fire service in the city is necessary, is not open to question. How that improvement is to be procured appears to be an undecided question; if it is to come direct from the Water Works, one of two things must be done: either the pumping capacity and the mains for distributing water from the pumping station throughout the city must be increased, or the quantity of water furnished for other uses than that of the fire department must be largely reduced; which shall be done? or shall the city be equipped with steam fire engines for fire protection? If this last expedient is adopted, how long will the time be postponed when it will be necessary to put in the additional pumping engines? Except within a narrow belt along the river, the steam fire engines will be of no use unless they are supplied with water from the water works. This makes it necessary for the water works to pump the same quantity of water they would if pressure was taken directly from the hydrants, except the additional

caused by an increase in the pressure. With a fully equipped fire engine department it would be necessary to keep the water in such condition as to furnish the fire department with what they might require, and also furnish an adequate supply for do- use, including a supply to the upper floors of the high buildings business part of the city. With a water works in condition to his demand with efficiency, is it not cheaper to make the addi- outlay necessary to make the works efficient for fire service than p and operate a steamer fire department ?

he persistent and at times very unpleasant surveilance of those ers who were not supplied through meters, which has been ry during the past year in order to furnish a moderately effi- re service, has been quite as disagreeable to the water works es as it has been to those consumers who thought themselves ed of some of the privileges for which they were paying, when ave been required to comply with the terms of the water works nce, and it has been the hope of those who had the disagreeable o perform that some means would be devised during the present to so increase the capacity of the works as to render this constant ance unnecessary. If this is not done, it will be necessary to meters to all pipes where it can be done conveniently, and to an inspector whose sole duty it shall be to watch those consum- metered, and see that they do not waste water unnecessarily.

hese expenditures will go far towards the purchase of a new ng engine, and when it is also considered that the saving in fuel for running a new and improved pumping engine from what is d to run the engines now in use, will more than pay the interest cost of a new engine, together with the satisfaction that con- will derive from not being restricted in their uses of water, and most absolute assurance of an uninterrupted supply—which latter o means certain as long as the engines now in use are the only e—it seems as though but one of the expedients could be t of.

he amount expended on pumping machinery accounts during the as $1,295.25 ; of which there has been charged on construction ts, $84.70 ; for completing separating the discharge of rotary from piston pumps, $58.70 ; expenses of committee examining



pumping machinery, $26.00. Amount charged to repairs to pumping machinery, $1,210.55 ; which is more than 50 per cent. of the entire amount previously paid on this account since the works were erected. This amount is probably a little larger than it will be for the coming year, on account of having replaced two of the piston pumps during the past year, but the expenditures for repairs will necessarily be large as long as the present engines are the sole reliance, and have to be run at the speed now necessary to supply the city.

Main Pipes.

The distributing mains in the city have been extended during the year as follows .

A line of ten-inch Wyckoff pipe has been laid on Johnson street from Woodside avenue to Center street, with fire hydrants at First, Second, Third, Fourth and Fifth street. A line of six-inch Wyckoff pipe has been laid on Twenty-third street, from Stanton to Fitzhugh street, with a fire hydrant at Bowery. Also a line of six-inch Wyckoff pipe on Fitzhugh street, from Twenty-third street to Twenty-second street, with a fire hydrant near the north line of Twenty-third street; and a line of the same size and kind of pipe on Broadway, from Twenty-third street to Fremont avenue, with fire hydrants at Twenty-fourth, Twenty-sixth, and Twenty-eight streets. The main pipe on Twenty-third street was cut and a branch put in to connect the pipe laid on Broadway, and the four-inch pipe leading to hydrant on Twenty-third street, between McCormick and Wilson streets, has been cut and a valve placed therein, leaving but two hydrants in the city without a valve, between the hydrants and the main.

The entire expense of these extensions of the main pipes, including valves and hydrants, was as follows :

Johnson street	$2,941 19
Twenty-third street	658 97
Fitzhugh street	282 66
Broadway	1,655 94
Alley between McCormick and Wilson street	12 91

Length of pipe laid on these lines :

	Feet.
10 in. iron and branches	17
6 in. iron and branches	21
Total of iron pipe	38

	Feet.
10 in. Wyckoff pipe	2,472½
8 in. Wyckoff pipe	9
6 in. Wyckoff pipe	3,799½
4 in. Wyckoff pipe (on hydrant branches)	149½
Total of Wyckoff pipe	6,430½

Pipe taken out :

	Feet.
6 in. Wyckoff	5½
4 in. iron	1

Valves set in mains :

8-inch	1
6-inch	4
4-inch	11

Fire hydrants set :

Holly's patent, 4 in. barrel, double discharge	10

Total main pipes connected with the works Dec. 31st, 1884 :

	Miles.	Feet.
30-inch stave pipe from bay	4	66
18-inch stave pipe from river		386
Total stave pipe	4	452

Distributing mains :

	16-in.	12-in.	10-in.	8-in.	6-in.	4-in.	3-in	Total.
iron	1,410	4,883	8,475¼	1,938¼	989¼	664½		18,360¼
off patent			10,600¾	13,217½	55,576¼	19,274½	319	98,988
otals	1,410	4,883	19,076	15,155¾	56,565½	19,939	319	117,348¼

	Miles.	Feet.
Total cast iron pipe	3	2,530¼
Total Wyckoff patent pipe	18	3,948
Total distributing mains	22	1,188¼

Whole number of valves :

30-in. in inlet from bay	1
18-in. in inlet from river	1

In distributing mains :

	16-in.	12-in.	10-in.	8-in.	6-in.	4-in.	3-in	Total
Flower's patent	1	4	11	28	79	174	3	300
Galvin's patent						11		11
Totals	1	4	11	28	79	185	3	311

Whole number of fire hydrants :

Holly's patent	118
Matthew's patent	41
Brown's patent	1
Total	160

All of which are double discharge post hydrants.

There are 15 DEAD ENDS in the main pipes of the city supply, which should be connected with other lines of pipe to complete the circulation as fast as possible. These dead ends are the cause of much complaint from consumers taking water from them for domestic use, and is the cause of considerable waste ; it being necessary to permit a large quantity to flow to waste to keep the water in suitable condition for use. Two of these dead ends would be connected by extending the pipe on Fitzhugh street from Fifteenth to Twenty-second street, and at the same time fire protection would be afforded a thickly populated portion of the city, and the supply to the south part of the city to some extent reinforced.

The pipe on Sherman street should also be extended south from Nineteenth to Twenty-second street, to afford fire protection in the vicinity of the Polish church, and with a view to remedying the dead end now existing on that street by connecting it in the near future with the main pipe on Twenty-third street.

The end on Trumbull street can only be connected by extending the pipe from Ninth to Tenth street, and laying a pipe on Tenth street from Trumbull street to connect with the pipe at Tenth and Sherman streets. This will involve a considerable expenditure with but little return from water rates, but will afford fire protection to property now entirely unprotected, and by extending the pipe on Johnson street to intersect this pipe on Tenth street, would afford material aid in furnishing fire pressure south of Tenth street.

The pipe on the north side of Center street should be extended from Sheridan street to Johnson street ; and there is a very urgent de-

and for a line of pipe in alley between Adams and Jefferson street, uth of Tenth street, for domestic supply, which should be complied th during the coming season if it can be reached.

When the water works were built, and for some time afterward, e city fire department were using the Feyh Patent Coupling on their se, and the fire hydrants were made with that coupling. A few years o the fire department changed the couplings on their hose to the Cas-ell Screw Coupling, but the couplings on the hydrants were not anged, the fire department using an intermediate coupling for attach-g to the hydrants. As it was not advisable to have part of the hy-ants in the city with one kind of coupling and part with another, all the hydrants put in on extensions are fitted with the Feyh coupling, creasing the trouble and expense of changing them each year. Chief ngineer Harding, of the fire department, believes it would be better the hydrants were fitted with the Screw coupling, and to avoid the ditional expense of changing any more couplings than those on the drants now in use, I recommend that a sufficient number of Screw upling hose nozzles be procured at once for all of the fire hydrants the city, and that they be placed in the hydrants as soon as prac-cable.

No leaks have been discovered in the iron main pipes during the ar. Twenty-six leaks have occurred in the Wyckoff main pipes, of hich three were defective pipes, which were removed and new sections t in ; 15 were small leaks in joints, repaired by caulking with pine, d eight were knot holes, which were readily plugged. The entire pense of these repairs, including labor and material, was $65.13. ive leaks were found in the connection where service pipes were con-ected with the main, and three leaks in service pipes between the ain and shut-off cock, which were evidently caused by excavation for wers, but not discovered until after the sewer contractors had com-eted their contract and their work had been accepted. These leaks ve been repaired at the expense of this department at an expense of 16.75.

The main pipe in the alley between Madison and Monroe streets, ear Woodside avenue, was lowered out of the way of branch sewer ; e main pipe in Harrison street at Thirtieth street was raised to make ay for Thirtieth street main sewer ; the mains on Twenty-third street,

between McCormick and Wilson streets, and in the alley between McCormick and Wilson streets, south of Twenty-third street, have been lowered on account of lowering the grade on Twenty-third street when it was paved; the fire hydrant on the corner of Center and Washington streets has been moved to the curb line of Washington street, as established when that street was paved, and the hydrants on the corner of Twenty-third and Webster, and Twenty-fourth and Water streets have been lowered to conform to the present grade by substituting four feet hydrants for the four and a-half feet hydrants formerly located at these points; the main pipe on Water street, in front of Lot 4, Block 31, Plat of Lower Saginaw, has been lowered to permit the area in front of the new Plumsteel block to be extended to the curb; and the hydrant corner of Harrison street and the Bullock road has been moved a short distance to permit a three-inch branch service to be connected with the same branch that supplies the hydrant. The expense of these removals and changes in the pipes has been $64.59.

The other work done on the pipe lines has been of a general character, consisting of keeping the fire hydrants in repair and working order, renewing valve boxes when they had become decayed; inspecting service pipes, turning on and shutting off water, etc., etc.

Water Meters.

The number of water meters put in during the year was 14, of the following sizes:

	3-in.	1½-in.	1-in.	¾-in.	½-in.	Total.
Union rotary	2	1	1			4
Crown			4	3	2	9
Worthington		1				1
Total	2	2	5	3	2	14

Meters have been taken out as follows:

	3-in.	2-in.	1½-in.	1-in.	¾-in.	½-in	Total.
Union rotary	1	1	1	2	1		6
Crown						1	1
Total	1	1	1	2	1	1	7

Whole number of meters now in use or shut off temporarily for the winter season, 44:

	8-in.	4-in.	3-in.	2-in.	1½-in.	1-in.	¾-in.	½-in.	Total.
Union rotary..	1	5	18	3	4	2			33
Crown.....						5	4	1	10
Worthington ..					1				1
Total.....	1	5	18	3	5	7	4	1	44

Of the meters set, one was put in to measure water used temporly for building purposes, and was taken out again; four were put in take the place of meters removed on account of not registering operly, or being of size not suited to the work; one was placed in pe supplying private dwelling; two at hotel; two at planing mills; e at street car barn; one at woodenware works; one at a machine op; and one at the county jail.

Two of the meters removed were taken out on account of not gistering properly, and were replaced by other meters; two were ken out and reset on other supplies, other meters of more suitable e being substituted for them; one was removed from a pipe which was ut off by reason of the use of water on the premises having been abanned; and two meters have been removed which were attached temrarily for the purpose of estimating the quantity of water used for ilding purposes.

There are now on hand in good order, new, or nearly new:

	2-in.	1½-in.	¾-in.	½-in.	½-in.	Total.
Union rotary.....	1		1	1		3
Crown.....		1			2	3
Total.....	1	1	1	1	2	6

There are also in the shop one two-inch Union rotary, and one oneh Union rotary, which will have to be repaired before they can be ed again.

The amount expended on repairs to meters during the year was 0.69. These repairs consisted of taking apart and cleaning 16 eters, taking out and replacing those changed, and packing those that quired it to protect them from frost.

The few meters now in use have been the means of securing to the y what measure of fire service has been derived from the direct pres-re system during the past three years; but, unless more pumping achinery is procured at once the number of meters must be largely creased, and with an increase in the capacity of the works it would

still be advisable to gradually extend the meter system until it shall embrace all of the business and manufacturing interests, and such dwelling houses as persist in a useless waste of water. That such extension of the meter system is the only means of holding in check the extravagant waste of water, and of bringing the works to a paying basis, is very evident. It is no more than just to those consumers now metered that others, especially those in the same line of business, should be placed under the same restrictions, and pay their water rates on the same basis. I recommend that a sufficient number of meters be procured before spring to meter all services one inch in diameter and upwards not already metered, and that they be set as soon as the weather becomes suitable for doing the work.

Service Connections.

There have been 91 taps and one branch service connected with the main pipes during the year, and two were taken out, making increase in service connections for the year, 90.

Service connections put in were of the following sizes:

	3-in B	1-in.	¾-in.	⅝-in.	½-in.	Total
In iron pipes			2	3	3	8
In Wyckoff main pipes	1	15	9	36	23	84
Total	1	15	11	39	26	92

Service connections taken out:

	⅝-in.	½-in.
In iron main pipes	1	
In Wyckoff main pipes		1

Whole number of service connections in main pipes:

	8 in. B	6 in. B	4 in. B	3 in. B	2 in. B	2 in	1¼ in	1 in.	¾ in.	⅝ in.	½ in.	⅜ in.	Total
In Iron		2	9			2	6	42	51	31	75	5	223
In Wyckoff	1	2	9	1	1	13		123	376	123	369		1,018
	1	4	18	1	1	15	6	165	427	154	444	5	1,241

Twenty-five branch services and 1,216 taps.

Twenty-eight services have been abandoned, new connections having been put in for supplying the same premises. Most of these abandoned services are shut off at the main pipe. One branch service has no pipe connected from it, the branch being plugged.

The whole number of separate and distinct services connected from taps and branches is 1,254, of which 1,054 are open, and 200 d. Of those closed five are metered pipes, closed during the win- onths, there being no water used on the premises except in the ıer. Two hundred and twenty-nine services have been shut off g the year, and 162 have been opened. Eighty-eight have been off for non-payment, 18 for leak in service, and 123 by reason of remises having been found vacant, or at the request of consumer. The expense of digging out stop boxes for the purpose of turning e water has been quite an item during the year, and I again call ttention of the Board to the necessity of adopting something more ole than the wooden box for protecting the shut off cock at the or lot line. Only 15 iron boxes have been put in during the past and the only way to secure their general use will be for the Board ohibit the use of anything else. A majority of consumers will not ny fixture more expensive than is required by the regulations, even s evident that it is to their own interest to use the more expensive e.

Water Pumped and Cost of Pumping.

ıe total quantity of water pumped during the year, as indicated by evolutions of the pumps, was 831,867,463 gallons, of which 816,- 511 gallons were pumped against an average pressure of 40 lbs. quare inch at the level of the pressure gauge in the engine house ; h is equivalent to a lift of 107 feet from the level of the water in vells; and 15,062,952 gallons were pumped against a fire pressure aging 84 lbs. per square inch at the level of the pressure gauge, h is equivalent to a lift of 212 feet from the level of the water in wells.

The actual cost of running the pumping engines was $9,049.30, as ws :

Fuel consumed	$3,816 76
Oil, packing, etc., used	418 84
Repairs to pumping machinery and arches	1,333 70
Engineers' and firemen's wages	3,480 00
	$9,049 30

Making cost per million gallons pumped	$10 88
Cost per million gallons raised 100 feet	10 00
Cost of fuel per million gallons pumped	4 59
Cost of fuel per million gallons raised 100 feet	4 22



WATER PUMPED.

MONTH.	PISTON ENGINES & PUMPS.			ROTARY PUMPS.			TOTALS.		FIRE RECORD.					
	Hrs. Run.	Revolutions.	Gallons Pumped	Hrs. Run.	Revolut ns	Gals. P'mp'd	Gals. P'mp'd	Daily Av'ge.	No. of Al'ms	Hrs. Run.	High'st Pres're	Lowest Pres're	Aver'ge Pres're	Gallons pumped
January	741.18	* 1,569,479	75,920,847	17.47	80,012	1,600,240	77,521,087	2,500,680	11	16.34	100	60	84	2,995,808
February	691.44	* 1,411,060	66,099,145	19 11	78,781	1,575,620	67,674,765	2,333,613	6	3.54	80	70	78	623.468
March	742.30	1,298,430	71,413,650	1.30	11,028	220,560	71,634,210	2,310,781	12	3.47	80	70	79	492,030
April	714.35	* 1,196,940	64,843,426	9.33	45,690	913,800	65,757,226	2,191,907	7	8.18	100	50	84	1,365,635
May	737.53	1,170,100	64,355,500	6.07	37,148	742,960	65,098,460	2,099,950	10	4.13	90	70	80	542,850
June	717.28	1,211,000	66,605,000	8.37	38,717	774,340	67,379,340	2,245,978	10	16.21	100	70	88	2,497,190
July	742.35	1,309,758	72,036,690	2.07	11,536	230,720	72,267,410	2,331,207	7	6.26	90	60	74	900,370
August	740.50	* 1,392,192	74,255,878	15.20	61,615	1,232,300	75,488,178	2,435,102	8	4.11	85	70	78	667,031
September	716.15	* 1,248,871	68,140,197	5.25	25,380	507,600	68,647,797	2,288,260	8	1.56	90	70	82	270,710
October	741.32	1,220,679	67,137,345	4.32	20,355	407,100	67,544,445	2,178,553	8	6.01	90	80	84	952,695
November	718.50	1,128,334	62,058,370	2.18	11,858	237,160	62,295,530	2,076,517	8	12.08	80	75	77	1,694,500
December	740.16	1,263,509	69,492,995	10.29	53,301	1,066,020	70,559,015	2,276,097	12	10.57	100	70	93	2,063,670
Totals	8745.46	15,420,352	822,359,043	102.56	475,421	9,508,420	831,867,463	2,272,862	107	94.46	100	50	84	15,065,952

*January—6,582 revolutions, 2 pumps; 545,516 revolutions, 3 pumps.
*February—24,347 revolutions, 2 pumps; 731,422 revolutions, 3 pumps.
*April, 75,956 revolutions, 3 pumps.
*August, 168,342 revolutions, 3 pumps.
*September—39,122 revolutions, 3 pumps.

The capacity of the 4 piston pumps was increased February 5th from 53 gallons to 54 gallons per revolution, the right front pump having a capacity of 14 gallons per double stroke, instead of 13. February 22d, the capacity of the 4 piston pumps was further increased to 55 gallons per revolution, the right back pump having its capacity increased to 14 gallons per double stroke.

The greatest quantity of water pumped in any one day was 2,923,- gallons, on the 22nd day of December, when the St. James Church ed.

The greatest quantity pumped in one day when there was no fire 2,783,000 gallons, August 16th.

The least quantity pumped in one day was 1,853,610 gallons, ay, May 4th.

The following table shows total quantity of water pumped each since the works commenced operations :

.....	142,477,725 gallons	1879	672,344,128 gallons
.....	294,714,798 "	1880	827,067,372 "
.....	416,756,579 "	1881	944,382,043 "
.....	518,197,129 "	1882	775,642,466 "
....	538,847,186 "	1883	773,942,702 "
.....	530,197,397 "	1884	831,867,463 "

Receipts.

The cash receipts for 1884 were from the following sources :

From water rates roll of 1880.....	$ 4 00	
" " roll of 1882.....	7 67	
" " roll of 1883.....	798 89	
" " roll of 1884.....	18,667 12	
Total from water rates.....		$19,477 68
Plumber's licenses.....		31 00
Rent of dock and boom.....		100 00
Oil and packing acct.....		4 23
Sale of service taps.....		347 00
Sale of stop boxes.....		26 25
Total cash receipts.....		$19,986 16

This amount has been deposited with the City Treasurer as per ipts on file, as follows, and placed to the credit of the water works l :

January 31st.....	$ 2,852 51
February 29th.....	1,158 77
March 31st.....	619 15
April 30th.....	2,716 92
May 31st.....	1,442 90
June 30th.....	609 20
July 31st.....	3,189 06
August 30th.....	1,077 49
September 30th.....	847 12
October 31st.....	3,030 65
November 29th.....	1,004 48
December 31st.....	1,437 89
	$19,986 16

A comparison of the receipts with those for 1883 show an increase of $1,235.97, of which $1,091.36 was from water rates. The total amount collected on roll of 1884, including metered water, was $18,667.12, and the amount uncollected on that roll $354.54, making total amount charged on the year's roll $19,021.66, an increase of but $212.30 over amount charged on roll of 1883, while the quantity of water pumped has increased from 773,942,702 gallons to 831,867,463 gallons. The amount charged for metered water was $3,687.80, a decrease of $607.97 from the amount charged for metered water in 1883, with a corresponding decrease in the quantity of water supplied through meters of 8,384,886 gallons. The amount charged assessment rates on roll of 1884 was $15,333.86, an increase of $820.53 over roll of 1883.

The whole quantity of water supplied through meters during the year was 47,695,941 gallons, which returned a revenue of nearly 7¾ cents per 1,000 gallons. The whole quantity of water delivered into the city as indicated by the strokes of the pumps was 831,867,463 gallons; deducting 10 per cent. for slip in pumps, etc., leaves 748,680,717 gallons as the quantity of water actually delivered. Assuming that 25 per cent. of this is used for public purposes, fire department, flushing pipes and sewers, supplying watering troughs, etc., would leave 561,510,538 gallons as supplied to consumers, or 513,814,597 gallons to those consumers who paid for water at assessment rates. This water returned a revenue if all collected of $15,333.86, which is a fraction less than three cents per 1,000 gallons. As those consumers who pay assessment rates probably pay quite as much per 1,000 gallons for the water needed for actual use as those paying by measurement, the difference represents the quantity wasted; which would amount to more than 300,000,000 gallons in a year, or nearly 1,000,000 gallons per day. From official reports I have taken the following statistics of two eastern cities which are generally metered:

Pawtucket, R. I.—Population in 1880, 19,030; number of services Feb. 1st, 1884, 3,456; number of meters, 1,919; quantity of water pumped for year ending Feb. 1st, 1884, 682,040,127 gallons; revenue, $64,101.40.

Fall River, Mass.—Population in 1880, 49,006; number of services Dec. 31st, 1884, 3,611; number of meters, 2,421; quantity of water

mped in 1884, 521,865,161 gallons; revenue, $66,667.80; besides e appropriation from the city for water used for public purposes.

A comparison of these figures with the statistics of our own supply given in this report, shows that while the revenue of these cities, as npared with the number of services, is not so much greater than that this city, there is an enormous difference in the quantity of water pplied, as compared with the number of services and amount of water es collected.

Disbursements.

For office expenses	$ 668 55	
Treasurer's salary, July 1st, 1883, to July 1st, 1884	100 00	
Superintendent and Secretary's salary for 1884	1,800 00	
Repairs and care of hydrants, valves and pipes	730 38	
Repairs to water meters	80 69	
Repairs to breakwater at bay	1,863 95	
Repairs to inlet	10 40	
Repairs to engine house	126 50	
Implements used on repairs	108 03	
Total maintenance, except pumping		$ 5,438 45
For engineer's and firemen's wages	3,480 00	
Fuel	3,824 18	
Oil, packing and engineer's supplies	484 57	
Repairs to pumping machinery	1,210 55	
Repairs to boiler arches	123 15	
Total pumping expenses		$ 9,122 45
Total maintenance accounts		$14,560 90
For service tap	$ 152 29	
Water meters	407 55	
Furniture and fixtures	45 01	
Pumping machinery	84 70	
Wyckoff pipe	4,231 93	
Iron pipe and branch castings	104 66	
Valves	204 29	
Fire hydrants	304 96	
Laying pipe	689 97	
Reservoir and breakwaters at bay, (stone)	555 50	
Buildings at bay	277 80	
Total construction accounts		$ 7,058 66
Total disbursements		$21,619 56

The details of these disbursements are as follows:

or Office Expenses:

For clerk hire	$ 367 00
Blank notices	15 50
3,300 postal notices printed	40 00
Postage stamps	21 60

Blank receipts	27 75	
Publishing notices	30 90	
Blank applications and returns	9 00	
Record blanks	8 00	
Paper and envelopes	7 65	
Record, account and memorandum books	5 40	
Publishing report for 1883	22 00	
Binding two volumes report	2 00	
Accountants examining books	31 49	
Telephone	40 00	
Coal	20 90	
Ink, pens, &c	6 73	
Repairs and cleaning office, &c	4 03	
Exchange and express charges	2 40	
Moving shop and fitting up room in tower	4 55	
Cans and freight on water to Prof. Kedzie	2 25	
		$ 668 55

For Salaries :

For Treasurer's salary, July 1st 1883 to July 1st, 1884	$ 100 00	
Superintendent and Secretary's salary for 1884	1,800 00	
		$ 1,900 00

For repair and care of hydrants, valves and pipes :

For labor repairing 26 leaks in Wyckoff pipe	$ 47 12	
Sleeves and pipes for these repairs	18 01	
Labor repairing leaks in service connections	7 37	
Labor repairing leaks in service pipes	9 38	
Labor raising and lowering pipes for sewers, and changes of grade	41 63	
Lowering pipe at Plumsteel block	6 50	
Moving hydrants for changes in grade and curb	9 50	
Pipe for moving hydrants	1 95	
Moving hydrant for branch service	5 01	
Digging out stop boxes	17 42	
Repairing hydrants and banking same	17 56	
Repairing valve boxes and covers	28 57	
Shop repairs to hydrants	10 81	
Extra labor inspecting services	19 00	
Labor on general repairs, inspections, turning on and off water	489 50	
Gasoline	1 00	
		$ 730 33

Repairs to water meters :

For labor taking apart and cleaning 16 meters	$ 18 00	
Labor taking out 5 meters, replacing 4	9 51	
Packing meters for winter	3 18	
		$ 30 69

airs to breakwaters at bay :

For 31,930 feet of oak plank	$ 552 41	
Oak piles	209 80	
Freight on plank	42 00	
Bolts and spikes	56 17	
Driving piles and clearing old work	374 50	
Labor on breakwaters and reservoir banks	629 07	
		$ 1,863 95

airs to inlet between reservoir and pumping station :

For repairing manhole at bay shore	$ 9 25	
Repairing valve at end of pipe	1 15	
		$ 10 40

airs to engine house :

For new valleys in roof, and slating	$ 68 90	
Repairs to windows and roof caused by explosion at Dolsen, Chapin & Co's	24 33	
Repairing fire room doors	17 74	
Water closet	21 28	
		$ 127 25
Deduction on Bay City Iron Co. acc't, May report		75
Per monthly reports		$ 126 50

lement account :

For lighter for work at bay	$ 58 00	
Wheelbarrows, shovels, &c., for bay	13 79	
Tools for street work	9 10	
Tools for engine house	9 60	
Repairing tools for street and bay work	11 14	
Repairing tools for engine house and call for fireman	6 65	
		$ 108 28
Deduction on Bay City Iron Co's acc't, May report		25
Amount per monthly report		$ 108 03

gineer's and firemen's wages :

For first engineer's salary	$1,200 00	
Second engineer's salary	960 00	
Firemen. (2)	1,320 00	
		$ 3,480 00

l accouut :

For Dolsen, Chapin & Co. for 3,704¼ cords slabs and edgings at 70 cts	$2,593 32	
Keystone Co'y, 113¾ cords slabs and edgings at 60 cts	68 25	
Delivering 3,704¼ cords from Dolsen, Chapin & Co. at 30 cts	1,111 43	
Delivering 113¾ cords from Keystone Co. at 45 cts	51 18	
		$ 3,824 18

Oil, packing and engineer's supplies :

For 47½ gallons Bing. cylinder oil at 90 cts	$ 42 75	
49 gallons Bing. cylinder oil at 65 cts	31 85	
Freight on same	3 95	
105 gallons carbolene valve oil at 70 cts	73 50	
Freight and cartage	2 39	
4½ gallons lard oil	4 50	
5 lbs. plumbago	1 25	
5½ lbs. rubber	2 84	
18 lbs. heston packing	27 00	
Express charges	50	
29¾ lbs. hemp packing	7 51	
8¼ lbs. cotton packing	3 30	
4 lbs. wicking	1 60	
2 yds. canvass	40	
12½ yds. packing paper	1 25	
48½ lbs. valve leathers	36 38	
Freight on same	1 00	
50 lbs. rivets	7 00	
13 lbs. red lead	1 50	
1 gallon oil	70	
15 lbs. tripoli	1 50	
1 box polish	25	
1 doz. emery cloth, ½ doz. emery paper	68	
787 lbs. wipers	52 99	
1 doz. brooms	2 75	
1 case concentrated lye	2 75	
Varnish	2 50	
5,699 lbs. sal soda	85 49	
Cartage on same	1 50	
9 bbls. kerosene oil, 457½ gallons	62 49	
Candles, lamps and chimnies	2 50	
Ice for engine house	18 00	
		$ 484 57

Repairs to pumping machinery :

For 2 new pumps, (right back and right front,	$ 426 64	
Extra labor putting in pumps	36 75	
Bolts	2 50	
Repairing feed pumps	10 63	
Repairing suction and discharge valve s	29 10	
Repairing R. B. connection rod	3 75	
New end on R. B. connection rod	48 00	
Repairing rocker arm	7 28	
Repairing rotary pump gear	7 50	
New elbow and branch on steam pipe	25 13	
Taking out and replacing flues in two boilers	380 52	
Putting braces in two boilers	163 90	
Repairing boiler flues	8 13	
Guage cocks and valves	7 88	
Gas pipe and fittings	22 13	
Whistle cord	60	
Sheet brass	2 80	

Paints and oils	10 85	
Grate bars	46 62	
		$ 1,240 71
Deduction on Bay City Iron Co. Acc't., May report..		30 16
Amount per monthly reports		$ 1,210 55

airs to boiler arches :

For 900 fire brick	$ 27 00	
7 bbls. fire clay	15 75	
Lime, mortar and sand	5 15	
Labor	75 25	
		$ 123 15

vice tap account :

For 2 doz. 1 in. corp. stops	$ 35 75	
2 doz. ¾ in. corp. stops	26 88	
3 doz. ½ in. corp. stops	27 36	
Freight, express charges and cartage	3 15	
Screws	65	
Labor	58 50	
		$ 152 29

ter meters :

For one 1½ in. Worthington and freight	$ 41 10	
One 1½ in. Crown	55 50	
Four 1 in. Crown	128 00	
Three ¾ in. Crown	70 50	
Three ½ in. Crown	42 75	
Freight on Crown meters	3 11	
Lumber and nails for boxing	17 02	
Two set of 3 in. meter connections and bolts	10 15	
Fittings for small meters	2 39	
Setting and boxing 6 meters	29 80	
Setting 3 meters	7 23	
		$ 407 55

rniture and fixtures :

For chairs for office	$ 10 00	
Gas fixtures, office and shop	4 17	
Pipe for pressure guage in office	30 84	
		$ 45 01

mping machinery :

For valve in discharge from rotary pumps	$ 58 70	
Traveling expenses of committee examining machinery	26 00	
		$ 84 70

Wyckoff pipe :

For 2461 ft. 4 in. of 10 in. pipe	$ 2,289 67	
9 ft. 1½ in. of 8 in. pipe and sleeve	9 27	
3795 ft. 10 in. of 6 in. pipe and sleeves	1,883 47	
146 ft. of 4 in. pipe	46 72	
Plugs, thimbles, &c	3 40	
		$ 4,231 93

Iron pipe and branch castings :

For One 10 in. ⅛ cast bend	$ 10 16	
One 10 in. by 6 in. tee	14 60	
Five 10 in. by 4 in. tees	69 00	
Five 6 in. by 4 in. tees	26 76	
	$	120 52
Deduction on Bay City Iron Co. acc't, May report.		15 86
Amount per monthly reports	$	104 66

Valves for street mains :

For one 8 in. Flower valve	$ 34 00	
One 6 in. Flower valve	22 00	
Eleven 4 in. Galvin valves	188 05	
Valve cases and covers	10 24	
	$	304 29

Fire hydrants :

For 10 No. 4 Holly hydrants and freight on same	$	304 96

Laying pipe :

For 6,566 ft. of trenching	$ 631 11	
Cutting main on Twenty-third street	3 50	
Extra work setting valves and hydrants	18 25	
Supervision and drayage	27 75	
Lead	86	
Boring castings for wood pipe	9 00	
	$	689 97

Buildings at bay :

For house at bay shore	$	277 80

Balances.

The balance in the Water Works Fund Jan. 1, 1884, was ...	$12,893 46	
Collections deposited with City Treasurer to the credit of that fund ...	19,986 16	
		32,879 62
Amounts withdrawn from Water Works fund by reqnisitions on the City Recorder:		
January 20th, Requisition No. 179 ...	$ 1,500 00	
February 28, " 180 ...	1,500 00	
March 29, " 181 ...	1,250 00	
April 28, " 182 ...	1,000 00	
May 30, " 183 ...	1,500 00	
June 28, " 184 ...	1,600 00	
July 29, " 185 ...	3,000 00	
August 29, " 186 ...	3,000 00	
September 29, " 187 ...	1,200 00	
October 30, " 188 ...	3,500 00	
November 28, " 189 ...	1,400 00	
December 30, " 190 ...	1,100 00	
		$21,550 00
Leaving balance in Water Works Fund, Dec. 31, 1884 ...		10,329 62
A decrease of ...	1,563 84	
The balance in the hands of the Treasurer of the Board, Jan. 1, 1884 (after deducting outstanding orders) was	525 95	
Amount deposited with said Treasurer ...	21,550 00	
		22,075 95
Orders drawn on the Treasurer ...		21,619 56
Balance in the hands of the Treasurer of the Board, Dec. 31st, 1884 (not covered by orders outstanding) ...		456 39
A decrease of ...	69 56	
Making total cash balance subject to the order of the Board less than at commencement of the year by ...	1,633 40	

This is certainly a step in the wrong direction, until some much
led large improvements are completed. It is to be hoped that the
nditures will not again exceed the receipts before additional
ping machinery is procured or other measures in force to render
present works more efficient.

The following balance sheet shows the balance of each account as
pears on the Ledger, December 31st, 1884 :

LEDGER BALANCES, DR.

Folio 488,	Interest, discount, and commissions on construction	$ 4,224	17
" 488,	Insurance account on construction	29	00
" 487,	Travelling expenses on construction	306	29
" 487,	Engineering and superintendence on construction	7,856	17
" 487,	Implement account on construction	1,713	61
" 486,	Furniture and fixtures	646	93
" 482,	Real estate	6,724	83
" 482,	Dock, tramway and store shed	1,882	63
" 482,	Engine house, chimney and wells	19,097	42
" 483,	Engine foundations, boiler foundations and arches	4,931	73
" 483,	Inlet from Saginaw river	3,218	99
" 483,	Inlet from Saginaw bay	84,778	37
" 484,	Reservoir and breakwaters at bay	22,047	28
" 484,	Filter at bay	1,683	13
" 484,	Pumping machinery	39,471	07
" 485,	Iron pipe and branch castings	53,068	91
" 485,	Wyckoff pipe	77,008	46
" 485,	Laying pipe	34,047	39
" 486,	Valves for street mains	9,174	41
" 486,	Public fire hydrants	8,022	74
" 488,	Buildings at bay shore	277	80
" 489,	Service stop boxes	12	31
" 489,	Water meters	5,920	15
" 490,	Water works fund	10,829	62
" 490,	Orrin Bump, treasurer	456	39
" 491,	Thomas Rosa	15	57
" 491,	A. L. Stewart	15	06
" 412,	Office expenses and salaries	22,052	11
" 416,	Repairs and care of hydrants, valves and pipes	6,725	29
" 416,	Repairs to reservoir and breakwaters	3,268	20
" 421,	Repairs to inlet from bay	10	40
" 417,	Repairs to Water meters	59	54
" 412	Engineers' and firemen's wages	42,032	84
" 413,	Fuel account	33,343	36
" 413,	Oil, packing and engineer's supplies	5,007	85
" 414,	Repairs to pumping machinery	3,550	22
" 414,	Repairs to boiler arches	664	08
" 415,	Repairs to engine house and insurance	572	77
" 415,	Repairs to dock	13	38
" 417,	Implements on repairs	852	20

LEDGER BALANCES, CR.

Folio 408,	Water rates rolls of 1872 to 1880, inclusive		$ 74,454 46
" 410,	Water rates roll of 1881		14,962 61
" 418,	Wates rates roll of 1882		17,230 02
" 418,	Water rates roll of 1883		18,676 21
" 419,	Water rates roll of 1884		18,667 12
" 411,	Plumber's licenses		257 70
" 411,	Rents, dockage, etc.		937 73
" 489,	Service tap account		1,544 70
" 481,	Bay City bond account ($377,000 bonds)		366,045 87
" 481,	Water assessment (frontage tax)		736 07
		$515,612 09	$515,612 09

Assessment for 1885.

The assessment rates for 1885 amount to $15,710.00, an apparent ase of $938.00 over the footings of the assessment roll of 1884 at ommencement of that year; but it is an increase of $1,107.00, as .00 of assessment rates at the commencement of 1884 are now lied through meters.

The assessment roll for 1885 embraces the following uses of water:

1 Ashery.
3 Bakeries.
3 Banks.
9 Barber shops.
190 Bath tubs (private).
9 Bath tubs (public).
1 Bath house (Turkish).
1 Billiard room (no bar).
4 Blacksmith shops.
10 Boarding houses.
5 Bottling works.
1 Brewery.
12 Butcher shops.
2 Carriage shops.
5 Churches.
1 Cigar factory.
2 Clothes cleaning shops.
1 Coffee roaster.
2 Cooper shops.
1 Cracker factory.
4 Drill houses.
606 Dwellings.
1 Electric light works.
138 families in blocks, and extra fami- dwellings.
4 Fire hydrants (private).
1 Fire lighter factory.
1 Flour mill.
3 Gas engines.
1 Gas works.
1 Green house.
1 Gun shop.
10 Halls (public).
3 Harness shops.
280 hose for sprinkling lawns.
1 Hospital.
49 Hotels.
1 Hydraulic elevator.
4 Laundries.
1 Library (public).
3 Machine shops.
1 Mattress factory.
85 Offices.
1 Paint shop.
3 Passenger depots.
6 Photograph galleries.
6 Planing mills.
2 Plumber's shops.
1 Postoffice.
4 Printing offices.
1 Reel factory.
12 Restaurants.
1 Roller rink.
2 Round houses, railroad.
124 saloons and hotel bars.
2 Salt blocks.
1 Salt crusher.
6 Schools (public).
1 Shingle mill.
1 Skate factory.
1 Soap factory.
118 Stables (private).
18 Stables (mill).
12 Stables (livery).
4 Stables (hotel).
1 Stone yard.
85 Stores.
2 Tailor shops.
1 Telegraph office.
1 Telephone oxchange.
416 Water closets (private).
184 Water closets (public).
44 Water closets (in schools).
2 Water motors.
1 Wood yard and coal dock.

The following uses are supplied through meters:

2 Bath tubs (private).
1 Boarding house.
1 County Court house.
1 County jail.
16 Drill houses.
44 Dwellings.
1 block, stores and families.
1 hose for sprinkling lawn.
2 Hotels.
4 Machine shops.
3 Offices.
1 Pipe works.
3 Planing mills.
14 Salt blocks.
15 Saw mills.
1 Saw mill dock.
1 Stable (private).
4 stables (mill).
1 Stable (street car).
11 Water closets (private).
19 Water closets (public).
1 Woodenware works.
1 Wood yard and coal dock.
72 Private fire hydrants and hose connections for fire purposes.

Water is supplied the several departments of the city government for the following described uses free of charge:

1 City building, police station, and city offices.
6 City hose and truck houses and stables.
7 Public drinking fountains.
2 Ornamental fountains in public square.
Hose for sprinkling public parks.
8 Water closets and urinals in city buildings.

The following shows amount collected, amount uncollected, and total charged on roll (including metered water) each year since the works commenced operations:

Year.	Amount collected.	Uncollected.	Total on Roll.
1873, January 1st to April 30th	$ 728 82		$ 728 82
1873-4, May 1st to April 30th	5,440 80	$ 1 60	5,442 40
1874-5, May 1st to April 30th	6,908 16	44 85	6,953 01
1875, May 1st to Dec. 31st	7,269 55	28 46	7,298 01
1876	9,571 26	82 73	9,653 99
1877	9,604 26	134 19	9,738 45
1878	10,078 15	324 71	10,402 86
1879	11,708 97	136 07	11,845 04
1880	13,144 49	136 50	13,280 99
1881	14,962 61	262 40	15,225 01
1882	17,320 02	200 30	17,520 32
1883	18,676 21	132 89	18,809 10
1884	18,667 12	354 54	19,021 66
Total	$144,060 42	$1,839 24	$145,919 66

The usual yearly examination of the books of the office was made
my report for 1883 was published. A copy of the report of the
untants making such examination is appended. I have also appen-
a statement of material used in running pumping engines for the
, and material on hand pertaining to that department at the close of
year, and a list of premises supplied through meters, with the size
cost of each meter set.

All of which is respectfully submitted.

E. L. DUNBAR,
Superintendent and Secretary.

Bay City, January 28th, 1885.

REPORT OF ACCOUNTANTS.

THE HONORABLE BOARD OF WATER COMMISSIONERS OF BAY CITY:

GENTLEMEN:—We, the undersigned accountants, employed to
nine the books and accounts of the Bay City Water Works for the
1883, would respectfully report as follows;

That we have carefully examined the records, vouchers, accounts
books of the Secretary and found them correct.

We have also examined all assessment rolls and have compared
same with stubs of receipts and find they agree with the daily
rd, also with the day book, and we find the ledger balances correct
er trial balance of the Secretary, January 1st, 1884, in his twelfth
ual report dated January 25th, 1884.

(Signed,) CHAS. F. BRAMAN.
(Signed,) DAN'L A. MARSHALL.
Accountants.

Dated Feb. 16th, 1884.

List of consumers supplied through meters:

Name of Consumer.	Use.	Size.	Cost Set.
McEwan Bros	mill, block, &c	3 in	$ 159 55
Dolsen, Chapin & Co	2 drill houses	¾ in	29 26
" " "	mill, office, &c	3 in	164 54
" " "	salt block	2 in	105 61
Eddy Bros. & Co	mill, block, &c	3 in	156 29
Folsom & Arnold	mill, block, &c	4 in	270 50
" "	2 drill houses	3 in	155 32
The Mich. Pipe Co	pipe works, &c	4 in	230 87
" "	" "	3 in	133 38
Pitts & Cranage	planing mill, &c	3 in	127 18
" "	mill. block, &c	4 in	243 21
" "	salt block, &c	3 in	132 27
Geo. Ford	machine shop	¾ in	33 35
A. N. Rouech	hotel and block	1 in	36 31
H. Griswold	dwelling, &c	½ in	14 47
Bay County,	court house, &c	1 in	52 14
" "	county jail, &c	¾ in	28 65
T. Riley Denison	wood yard & dock	1½ in	48 66
S. G. M. Gates	mill	3 in	126 35
F. E. Bradley & Co	mill and salt bl'k	4 in	238 32
Eddy, Avery & Eddy	mill dock	3 in	126 25
" " "	mill and block	3 in	132 75
Smalley Bros. & Co	machine shop	3 in	122 72
McKinnon M'fg Co	machine shop	¾ in	25 63
Industrial works	machine shop	3 in	130 56
Jas. Clements & Son	office, &c	1 in	27 25
Wm. Peter	mill and block	3 in	132 25
N. B. Bradley & Sons	mill and block	3 in	132 90
" " "	drill houses	1½ in	56 26
" " "	drill houses	1½ in	62 04
Hay, Butman & Co	saw mill	2 in	78 08
A. Rust & Bro's	salt block	1 in	40 30
" "	mill	3 in	154 81
" "	mill dock	4 in	232 91
G. Hine	slaughter house	1 in	38 50
S. McLean, Son & Co	saw mill	2 in	76 37
" "	salt block	1½ in	49 80
B. H. Briscoe & Co	planing mill	1½ in	49 75
Miller & Lewis	saw mill	3 in	136 22
Daniel McDonald	hotel	1 in	42 43
Bay City Street Railway Co	barn and dwelling	1 in	45 02
Bousfield, Perrin & Co	wooden ware works	3 in	115 65
S. G. Rice & Sons	planing mill	3 in	118 05
Birdsall & Barker	mill, &c	8 in	952 17
			$5,564 90
Elevator Indicator			$ 32 50
Material per inventory			289 13
Labor on 4 meters since taken out and not replaced			33 62
			355 25
			$5,920 15

Material used in running pumping engines during the year 1884:

3,812 cords slabs and edgings	$3,816 76
1 gallon plus oil	1 20
112 ½ gallons Binghamton cylinder oil	102 94
54 gallons carbolene valve oil	38 92
4 gallons lard oil	4 00
3 lbs. plumbago	75
18 lbs. square rubber packing	9 00
9⅛ lbs. sheet rubber	4 11
4½ lbs. rubber gaskets	2 50
7 lbs. heston packing	11 00
14¾ lbs. hemp packing	3 76
13¾ lbs. cotton packing	5 50
2 lbs wicking	80
Canvass	13
12½ yards packing paper	1 25
1½ lbs. calfskin leather	1 42
22½ lbs. valve leathers	17 88
36 lbs. rivets	4 90
14 lbs. red lead	1 62
2 gallons boiled oil	1 45
14 lbs. tripoli	1 40
1 lb. rotten stone	15
1 box polish	25
½ lb. oxalic acid	12
⅛ doz. sheets emery cloth	30
½ doz. sheets emery paper	06
729 lbs. wipers	51 03
13 brooms	3 07
½ dozen boxes concentrated lye	35
3,899 lbs. sal. soda	59 99
Varnish	2 50
463½ gallons kerosene oil	64 27
Lamps, reflectors and chimneys	2 85
Candles	10
Matches	1 07
Nuts	18
Ice	18 00
Total consumed	$4,335 60

Material on hand January 1st, 1885, for running pumping engines:

26 cords slabs and edgings	$ 26 00
51 gallons carbolene valve oil	36 97
1 gallon lard oil	1 00
2 lbs. plumbago	50
6 lbs. square rubber packing	3 00
2 air pump valves	9 38
2 lbs. sheet rubber	60
17 lbs. Heston packing	25 50
3½ lbs. rubber gaskets	1 75
15 lbs hemp packing	3 75
2 lbs. wicking	80
Canvass	27
19 lbs. sole leather	6 65
½ lb. calfskin leather	48
26 lbs. valve leather	19 50
14 lbs. rivets	2 10
3 lbs. red lead	38
2 lbs. tripoli	20
½ lb. oxalic acid	13
½ doz. sheets emery cloth	30
42 lbs. wipers	2 94
3 brooms	68
42 boxes concentrated lye	2 40
1,800 lbs. sal. soda	27 00
18 gallons kerosene oil	2 25
3 lamp chimneys	45
45 boxes matches	53
Blank nuts	31
	$175 85

Fourteenth

ANNUAL REPORT

—OF THE—

Superintendent of Water Works

Bay City, - Michigan,

For 1885.

BAY CITY, MICH.:
TRIBUNE BOOK AND JOB ROOMS
188.



FOURTEENTH

ANNUAL REPORT

OF THE

Superintendent of Water Works,

BAY CITY, MICHIGAN,

FOR 1885.

BAY CITY, MICH.:
TRIBUNE BOOK AND JOB ROOMS.
1886.

BOARD OF WATER WORKS.

January 1, 1886.

First Ward.

ANDREW WALTON.....Term expires September 6th, 1887.

Second Ward.

G. HENRY SHEARER.....Term expires September 6th, 1888.

Third Ward.

B. F. RAY.....Term expires September 6th, 1889.

Fourth Ward.

JOHN D. McKINNON.....Term expires September 6th, 1890.

Fifth Ward.

CHARLES E. YOUNG.....Term expires September 6th, 1886.

Sixth Ward.

DUNCAN McGREGOR.....Term expires August 4th, 1889.

Seventh Ward.

GEO. C. MEYERS.....Term expires August 4th, 1890.

OFFICERS.

President.....ANDREW WALTON.
Superintendent and Secretary.....E. L. DUNBAR.
Treasurer.....ORRIN BUMP.
First Engineer.....A. B. VERITY.
Second Engineer.....FRED H. HOLLY.

THE HON. THE BOARD OF WATER COMMISSIONERS OF BAY CITY:

GENTLEMEN—In compliance with the regulations of the Board, I e the honor to submit my Fourteenth Annual Report; the same ng for the year ending December 31st, 1885.

CHEMICAL ANALYSIS.

When the construction of the Bay City Water Works was com-nced in 1872, very little attention had been paid by the general blic to the quality of a public water supply; if the quantity were ple and the water reasonably clear, all requisite conditions were met.

The importance of a careful chemical analysis was not appreciated, ither were the facilities for obtaining a reliable analysis as accessible at the present time. Within the past few years the quality of the ter supplied to cities through their public water supply has become e of the most important questions to engage the attention of the edical and engineering professions, and through the discussion in blic meetings of associations and boards composed of members of ese professions, the attention of the general public has been called to e importance of this matter.

The purity of the water supplied to this city through the public ter supply having been seriously questioned, it was determined that areful and complete chemical analysis of the supply at it source, and different points in the distribution, should be procured, also analyses samples taken from other points in the bay, for the purpose of termining whether, and to what extent, the quality of the supply could improved by taking the supply from any other point.

Dr. Albert B. Prescott, Dean of the School of Pharmacy of the State niversity at Ann Arbor, was engaged to make the several analyses, and a mmittee consisting of Commissioners Shearer, McGregor and Ray, as appointed July 7th to procure the necessary samples. Under the

direction of this committee, fourteen samples were taken from different points as hereinafter described and forwarded to Dr. Prescott without any information as to the source from which they were taken until after analysis. The several samples were identified by numbers as follows:

No. 1. Taken from about one mile N. N. W. from the mouth of the Kawkawlin river, in water 11 feet in depth, July 23d.

*No. 2. Taken from about four miles N. E. from the mouth of the Saginaw river, in water 21 feet in depth, July 23d.

No. 3. Taken from about three and one-fourth miles east from the mouth of Saginaw river, and one mile north from the present inlet works, in water 10 feet in depth, July 23d.

No. 4. Taken from inlet cut of the present works at outer end of breakwater, July 23d.

No. 5. Taken from the inlet basin at the bay, at the outer end of the pipe leading to the pumping station, July 23d.

No. 6. Taken from the main channel of the Saginaw river opposite the Water Works pumping station, July 23d.

No. 7. Taken from same point as No. 5, August 11th.

No. 8. Taken from well at pumping station, inner end of pipe leading from the bay, August 11th.

No. 9. Taken from hydrant near the corner of Fourth and Water streets, August 14th.

No. 10. Taken from hydrant near the corner of McGraw avenue and Harrison street, August 14th.

No. 11. Taken from same point as No. 8, but when there was a large quantity of sediment in the water from flushing the pipe, sample taken August 22d.

No. 12. Taken from a point 3,000 feet N. N. E. from the present inlet basin, in water 7½ feet deep, September 25th.

No. 13. Taken from a point 5,500 feet N. N. E. from the present inlet basin, in water 10½ feet deep, September 25th.

*(The vessel containing sample No. 2 was accidentally broken after it reached the city, and was duplicated from the same locality the following day, July 24th.

No. 14. Taken from about two miles north from the mouth of the kawlin river, and one and one-half miles from the west shore of the in water 16 feet deep, September 27th.

The first six samples were forwarded to Dr. Prescott July 25th, the following preliminary report of the analysis was received ust 11th:

ALBERT B. PRESCOTT,
CHEMICAL LABORATORY, UNIVERSITY OF MICHIGAN.
ANN ARBOR, August 10th, 1885.

.. DUNBAR, SUPERINTENDENT:

DEAR SIR—I inclose a schedule report of my determinations of the vaters; also an outline of opinion as to the same, giving briefly the prac- results. I will make a full explanatory report in detail, either before ter making the analyses of other samples, as you have mentioned, and ou may find serviceable. Very truly yours,
(Signed) ALBERT B. PRESCOTT.

Nos. 1, 2 and 3. Moderately pure waters. No. 1 is quite satisfac-, the best of these three. No. 2 does not stand as well as No. 1 in ect to purity. As to hardness, No. 1 and No. 2 are near the line of waters. No. 3 is very moderately hard.

Nos. 4, 5 and 6. Not satisfactory in respect to purity—taking n as received. No. 4 is the best, No. 6 is the poorest of these three, o purity. These are alike hard water, but not very hard.

(The schedule report or tabulated statement accompanying this ort is omitted here, as it is fully covered in the tabulated statement ch accompanies Dr. Prescott's final report.)

Samples Nos. 7, 8, 9 and 10 were shipped to Dr. Prescott August h, and on the 15th of September a tabulated statement of the result he analysis of these waters was received, which statement is also braced in the statement accompanying the final report, and is here itted.

Samples Nos. 11, 12, 13 and 14 were shipped to Dr. Prescott otember 28th, and before making his final report, which was rendered tober 24th, he was notified of the locality at which each sample was en. Dr. Prescott's final report and conclusions are given as follows:

ALBERT B. PRESCOTT,
CHEMICAL LABORATORY, UNIVERSITY OF MICHIGAN.
ANN ARBOR, October 24th, 1885.

WATERS FROM THE BOARD OF WATER WORKS, BAY CITY, MICH. Nos. 1 TO 14 RECEIVED FROM MR. E. L. DUNBAR, SUPERINTENDENT. SEE ACCOMPANYING TABULAR STATEMENT OF QUANTITATIVE RESULTS OF CHEMICAL ANALYSES.

For the purpose of description, these fourteen waters may be grouped as follows:

I. Waters in all respects suitable for city use as public waters. The measures of organic matter come fully within the limits of safety. The inorganic constituents wholly unobjectionable. Only a very slight amount of suspended matter, which quickly subsides. (The chlorides equivalent to 0.6 to 0.7 grains chlorine per gallon.) Nos. 1, 2, 13, 14.

II. Waters not quite satisfactory for public use as city waters. The measures of organic matter approach too nearly the extreme limits of safety. The quantity of chlorides of inorganic orgin much larger than is desirable. A variable, sometimes large, amount of suspended matter, all subsiding readily. (The chlorides equivalent to from 11.7 to 13.7 grains of chlorine per gallon.) Nos. 8, 9, 10 and 11.

III. Waters not quite satisfactory for public use as city waters. The measures of organic matter average about the same as those of group II. The quantity of chlorides of inorganic origin less than half that in group II, but still larger than is desirable, and from three to six times the quantity found in group I. The suspended matter does not differ from that in group II. (Chlorides equivalent to from 1.7 to 4.2 grains of chlorine to the gallon. Nos. 3, 4, 5, 7 and 12.

IV. Unsuitable for public use. The measure of organic matter, especially non-nitrogenous matter, exceeds the limits of safety. The chlorides, of inorganic origin mainly or wholly, the same in quantity as the highest proportion found in group III. Suspended matter not greater than in group III. (Chlorides equivalent to 4.2 grains chlorine per gallon.) No. 6.

A summary of the detailed analytical results of chief importance may be presented as follows, for the several groups of waters:

	Group I.	Group II.	Group III.	Group IV.
Albumenoid ammonia, in parts per million, average for each group	0.125	0.172	0.174	0.220
Reduction of permanganate, scale of 1 to 10, average for each group	"1¼"	"4¼"	"5 4-5"	"10"
Sedimentary matter	very little.	Considerable, varying quantities		
Chlorine in chlorides in grains per gallon:				
Averages each group,	0.612	12.862	3.218	4.200
Highest " "	0.700	13.708	4.200	
Lowest " "	0.583	11.660	1.685	

(The reaction for lime shows the quantity of lime salts to be distinctly larger in group II. than in the other groups.)

The groups are quite sharply defined by the proportions of chlorine, pt group IV., which in respect to chlorine would fall in group III. Examination of the tabular statement of results in detail will show e considerable differences, in quantity of albumenoid ammonia, be- n waters in the same group. It is probable that considerable dif- nces have resulted from variable proportions of sedimentary matter ng been taken in the portions under analysis. The water of the le sample was shaken before taking out for analysis, but the rapid idence still prevented perfect equalization. The notable feature in series of waters is the very large proportion of chlorides in some of n. FOUR of the waters have a nearly uniform minute quantity of rides, equivalent to 0.6 to 0.7 grain chlorine per gallon. These ers being quite pure in respect to organic matter, and nearly clear ediment. (Group I.)

FIVE of the waters (those of group III.) carry the varying quantities .7 to 4.2 grains chlorine per gallon, and are not so pure, as to or- ic matter, or so free from sediment as the four waters of group I. n FOUR of the waters (in group II.) contain large quantities of rides, yielding 11.6 to 13.7 grains chlorine from a gallon of water, these waters have no more organic matter, and on the average no e sediment than waters of group III. Comparing group III. with up I., we find that the larger quantity of chlorides in group III. can- result from the admixture of ordinary sewage with chlorides of or- ic origin, because there is not so much organic matter, and not rly so much nitrogenous organic matter in waters of group III. as t accompany all their chlorides if of animal or sewage origin. refore inorganic origin is ascribed to these chlorides. Now in group the chlorides average four times the quantity of chlorides in waters roup III., while the organic matter is no higher in the former than he latter, and the suspended matter is about the same in each of se groups. It appears, therefore, that the chlorides of group III. y with them some organic matter, not largely nitrogenous, and some iment, but not enough nitrogenous organic matter to indicate or- ary sewage; and it appears that the great increase of chlorides in up II. compared with group III., is not accompanied with any in- ase of organic matter whatever.

From the information of the Superintendent (received after analyses Nos. 1 to 10), it is seen that group I. embraces the distant waters of bay; group II., the waters of the city distribution and pumping tion; group III., the near waters of the bay in and next to the inlet in; and group IV., one sample from the river, opposite the pumping tion. Taking, with this statement of sources of the waters, certain well- own local conditions, it appears that group I. represents the primary ters of the bay, nearly or quite one with the virgin waters of Lake

Huron itself (see further on), and that this primary water has suffered certain additions which it is one of the tasks of the analytical chemist to characterize. The waters of group III. are such as would result from an addition of the river water (group IV.) to the distant waters of the bay (group I.), with some atmospheric oxidation, purifying the mixed waters from a portion of the organic matter carried in the river water. If, however, the waters of group III. receive no other chlorides beside those contained in the river water, then it is highly probable that the chlorides in the river water average a larger quantity than that of the single sample of river water analyzed. The waters of group II. must have received a large addition of chlorides between the inlet basin in the bay and the pumping station in the city, and this is an addition of (inorganic) chlorides alone, not accompanied with organic matter or the oxidized remains of organic matter. This is shown very clearly, as already mentioned, by the direct evidence that in respect to organic remains, the waters of the city are every whit as pure as the waters of the inlet basin. The chlorides added between the inlet basin and the pumping station are mainly sodium chloride, or common salt, but include some smaller proportions of calcium chloride. Without a quantitative analysis for lime and magnesia, a more definite statement cannot be made on this point.

Regarding the waters of group I. in their approach to the virgin waters of Lake Huron, this further must be said: No analysis of the water of central Lake Huron has been made, to the knowledge of the writer, and little has been yet done to supply data of the waters of the great lakes, as a whole. In 1882 the writer, with another, made an analysis of Detroit river water (Annual Report of the Board of Health of Detroit, 1882, p. 224-238), by which it appears that this water holds 0.437 grains chlorine per gallon. This is one-fourth less in quantity than the minute quantity of chlorine found in three of the waters of group I., and about 3-10 less than the average chlorine in group I. Chlorine as an indestructible constituent, capable of exact determination, is the best criterion of admixture of any drainage containing common salt.

Taking now in consideration the variations from season to season, and the limits of analytical exactness in determination of millionths, it is impossible to say, from a comparison with Detroit water in 1882, that the waters of group I. have received any measurable addition of local chlorides, but it can be said that quite probably a trace of local chlorides has been added to these distant waters of the bay. The figures imply an addition of from 0.145 to 0.174 of a grain of chlorine to the gallon. So small an addition, if made by the river water (No. 6), could not carry any addition of organic matter past the oxidizing influences of several miles of the bay. At all events, the organic matter in the waters of

p I. falls within the recognized limits of safety. But it does not
le us to class group I. as "waters of extreme purity" and does not
that degree of extreme purity which might be expected from the
rs of central Lake Huron.
As to the waters of the city distribution, group II, it has already
stated that in respect to purity they "are not quite satisfactory"

inaw bay. The slight difference between Nos. 13 and 14, and the
t difference between them and No. 12 prove conclusively that the
above described is the dividing line between two separate and
nct qualities of water. And the waters of the inlet basin are quite

Huron itself (see further on), and that this primary water has suffered certain additions which it is one of the tasks of the analytical chemist to characterize. The waters of group III. are such as would result from an addition of the river water (group IV.) to the distant waters of the bay (group I.), with some atmospheric oxidation, purifying the mixed waters from a portion of the organic matter carried in the river water. It

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p I. falls within the recognized limits of safety. But it does not le us to class group 1. as "waters of extreme purity" and does not n that degree of extreme purity which might be expected from the rs of central Lake Huron.

As to the waters of the city distribution, group II, it has already stated that in respect to purity they "are not quite satisfactory" approach too nearly the extreme limits of safety. Analysis does varrant their positive condemnation as hurtful waters, it simply es them as doubtful waters. The following comparisons will ort these conclusions:

	Albumenoid Ammonia in parts per million.
ge of group II. city waters	0.174
Leed's general standard of purity of river waters of the United States, as sources of supply, 1883	0.010 to 0.280
n waters, Prof. Chandler's summary, January 1885	several above 0.200
delphia waters	not unusual 0.180
delphia waters	occasional 0.250
l Rapids city waters	0.178

Respecting the chlorides, both as total chlorides, mainly common and as containing slight additions of earthy chlorides, the writer nes to the opinion that on the one hand such a proportion of chlorides ot desirable, and on the other hand it is not clearly and positively ıful.

Respectfully submitted,

(Signed) ALBERT B. PRESCOTT.

It is a fact well known to persons familiar with Saginaw bay ers that at all times, except it may be for a few days after a heavy h-east blow, there is a well defined line between the brown waters ne shore and rivers, and the blue outside waters of the bay. The iminary reports on samples numbered 1 to 10 having shown such a ked difference between those taken from inside this line and those outside of it, Nos, 12, 13 and 14 were taken with a view to deter- ing whether this difference was carried up to the line without mate- change. No. 12 was taken from a few hundred feet inside this , No. 13 from a short distance outside of it, and No. 14 from a long ance out, near the west shore of the bay, where it was believed the t water would be procured this city could think of obtaining from ginaw bay. The slight difference between Nos. 13 and 14, and the at difference between them and No. 12 prove conclusively that the above described is the dividing line between two separate and inct qualities of water. And the waters of the inlet basin are quite

as pure as can be obtained from any point inside of that line, therefore any extension which falls short of reaching the blue outside waters of the bay would prove valueless.

From as close attention as your superintendent has been able to give to the matter, it is believed that an extension of 6,000 feet from the present inlet basin would be sufficient to reach this outside water, with the exception of a few hours at long intervals, and would give to this city, with the improvements hereinafter suggested, a water supply nearly equal in purity to that of Detroit or Cleveland, and superior to that of Chicago or Milwaukee.

As the water at this distance out is only about 11 feet in depth, the supply could not be depended upon during a short time in the spring and fall, there being some danger of its being cut off either by drift or anchor ice. As we would have no desire to suffer the experience of some other cities taking their supply from the great lakes, through having the city supply cut off entirely for some days, and with the knowledge of the river water obtained from Dr. Prescott's analysis, it is not desirable to use that as a source of supply unless absolutely necessary, it will be advisable to maintain the present inlet basin in condition for use, if the pipe is extended as suggested.

The preliminary reports of Dr. Prescott having proven what was before suspected, a large increase in the quantity of salt contained in the waters of the city distribution above that contained in the waters of the bay, a committee consisting of Commissioners McKinnon, Ray and Shearer was appointed October 6th to examine into the matter, and if possible locate the cause and proper remedy. The first point to be determined was the locality where the salt was received into the waters. Where the inlet pipe crosses the property of Mr. J. R. Hall is a bed of sand reaching the entire distance across said property and from the surface to below the grade of the pipe. Since this pipe was laid Mr. Hall has erected a large salt block upon his property, the drainage and packing bins of which block are immediately over the water works pipe.

Considering the method of construction of this pipe and the fact that nothing but a strata of sand intervened between it and the drainage of the salt block, there was but little doubt as to where the trouble was located. That there shoulld be no questioning this conclusion, samples of

ter were taken from the man-hole in the pipe between Mr. Hall's
perty and the bay, also from the two man-holes between Mr. Hall's
perty and the pumping station, and forwarded to Dr. Prescott for
alysis November 13th. These samples were identified by letters A,
and C, A being taken from the pipe between Mr. Hall's property and
bay. Dr. Prescott's report of these analyses, received December
, is here given:

ALBERT B. PRESCOTT,
CHEMICAL LABORATORY, UNIVERSITY OF MICHIGAN.
ANN ARBOR, December 1st, 1885.

DEAR SIR—I enclose reports of analyses of waters A,B,C, also certain
ditional (mineral) analyses of Nos. 6 and 14. First I determined the
lorine in the three November waters as the chief criterion respecting
ainage. Now it is manifest that the chlorine of brine can be calcu-
ed into chloride of sodium. But drainages carrying bitterns left from
lt manufacture would be likely to have some proportions of calcium
loride (with lime as the base), and of magnesium chloride (with mag-
sia as the base). The chlorine (total) will be combined with the (1)
dium, (2) calcium, (3) magnesium. And therefore I have made anal-
es to determine the calcium, and the magnesium, in A, B and C, and
so in No. 6 (the river water) and No. 14 (the far out water of the bay),
e last two giving some indications perhaps of the source of a part of
e calcium and magnesium in A, B and C.

With this explanation of the design of these analyses, the figures
results can be interpreted by you, probably better than by me. The
lorine will give you the principal information you seek for, as to
here the drainage enters. If desired, I can calculate the chlorine of
ese five waters into (1) chloride of sodium, (2) chloride of calcium, (3)
loride of magnesium, giving quantity of each in each. As to the cal-
um and magnesium, for the most part they increase with increase of
lorine, but not in so high a ratio as that of the chlorine. While the
lorine quantities of B and C are 26 and 28 times that of the distant
ater of the bay, the calcium quantities are only 3+ times larger in B
nd C than in No. 14, and the magnesium quantities only about 3 times
rger in B and C than in No. 14. I may add that we found Detroit river
ater in 1882, to have 34.8 to 36.0 parts per million of lime, and 12.1 to 12.7
arts per million of magnesia, showing again how near No. 14 ap-
roaches to Detroit river water. Very truly yours,

[Signed] ALBERT B. PRESCOTT.

BAY CITY WATERS, NOVEMBER 1885.

	A.	B.	C.	No. 6.	No. 14.
Chlorine (of chlorides)					
Parts per million	58.0	265.0	284.0	72.0	10.0
Grains per gallon	*3.383*	*15.458*	*16.567*	*4.200*	*0.583*
Lime (as calcium oxide)					
Parts per million	79.072	116.928	105.952	78.624	31.136
Grains per gallon	*4.614*	*6.819*	*6.177*	*4.586*	*1.815*
Magnesia—					
Parts per million	30.558	49.874	53.333	36.468	16.432
Grains per gallon	*1.779*	*2.911*	*3.109*	*2.129*	*0.957*

(Signed) ALBERT B. PRESCOTT.

December 1st, 1885.

The result proved conclusively that the contamination occurred at the suspected point. It will be seen by reference to Dr. Prescott's report of October 24th, that he does not consider the addition of the chlorides as positively harmful. This is, of course, from a purely sanitary point of view, considering the waters for domestic use only; that their presence is very detrimental to the use of these waters for mechanical purposes, especially for supplying steam boilers, is unquestionable, and means should be devised as soon as possible to correct the difficulty. This will involve an expenditure beyond the means at the disposal of the Board, unless all other improvements of every nature are entirely stopped for one year, perhaps longer. An iron pipe laid across this bed of sand appears to be the only means of correcting the difficulty, and the length of time such a pipe will last in such a locality is uncertain.

That this city can be supplied with water of much greater purity than that it is now receiving through the public water supply, is now evident, and that, too, with an expenditure which would still leave the total cost of the water works below that of many other cities of the same population. Nothing could do more to advance the interests of the city than a pure water supply.

Source of Supply.

The entire supply has been taken from the bay except for 13¼ hours, during which time the valve controlling the supply from the river has been partially opened. The dates and lengths of time the river pipe has been partially opened are as follows:

	Hours.	Minutes.
January 26th	0	27
January 29th	0	20
January 31st	0	10
February 1st	1	0
March 20th	1	25
March 25th	0	30
April 20th	1	30
April 29th	0	40
May 10th	1	8
May 16th	1	10
June 13th	1	0
December 2d	4	5
Total	13	15

During the spring and early summer months there was a large ount of sediment carried in the water, the nature and origin of which vas difficult to determine. Before a complete chemical analysis was ided upon, through the kind assistance of a local physician it was nd that this sediment consisted largely of decaying wood. As this liment was found in the water in much larger quantities after a fire, for any other cause there had been an unusually rapid flow of water ough the large pipe leading from the bay, it was at first feared that s sediment came from the inner surface of that pipe, and that it was idly decaying; subsequent investigation, however, proved that this s not, to any great extent, the case. It was found that the same liment existed in the waters of the bay, near the shore especially, and netimes in considerable quantities. As the flow through this large pe is at times quite sluggish, and the sediment settles readily, it is posited in considerable quantities in that pipe, to be disturbed and ought into the city when the flow is increased. The cause of the creased quantity of this sediment in the waters of the bay during the st two years, is the high water, which has reached and set afloat large antities of drift wood that has been lying along the shores for several ars just out of reach of the water, and which has become much ecayed. The ammonia in the water, developed by the chemical alyses, is probably due to a large extent to the presence of this ecaying wood.

Inlet Works at the Bay.

The work of renewing the breakwaters at the bay was continued ring the winter of 1884 and 1885, 476 feet of new breakwater being

constructed, and 98 feet of old work being strenthened by driving an additional row of piles four feet from the old breakwater and filling the space between with stone. One hundred and forty feet of new breakwater was built by driving two rows of piles four feet apart and filling the space between with stone. The work of filling the new breakwater with stone had just been completed, and backing up the old work with stone commenced, when the question of extending the inlet into the bay was broached, and it was thought advisable to discontinue the stone filling. That this was an error was proven when on the 4th of December occurred the most severe storm that has been known on Saginaw bay for many years. This storm carried away nearly 1,000 feet of breakwrter not backed up with stone, but disturbed none of the work that had been filled with stone. The breakwater carried away will now be replaced by double rows of piles, stone filled, contracts having already been made for the necessary piles and for driving them. The material purchased for this work during the year consisted of 207 piles, 4,380 feet of oak plank, 260 lbs. boat spike and 64¼ cords stone.

The inlet works have been kept in good condition as regards accumulation of driftwood and debris, Mr. L. D. Carpenter having been employed during the season on repairing the breakwaters and reservoir banks, and keeping the reservoir and inlet cut in as good condition as practicable. He resides in the house erected on the shore, and the works are cared for in a much more satisfactory manner than was possible with only such occasional visits of inspection as had been before in vogue. Whatever action is taken toward extending the inlet works into the bay, this shore basin should be maintained for reasons set forth in a former portion of this report.

Pumping Machinery.

No action has been taken during the year towards securing additional pumping machinery. The Board having done all that lay in its power to secure this much needed improvement, if the city council cannot be made to see its necessity, it only remains for the employes of the works to do the best they can with what they have. The extension of the meter system will, no doubt, in the future as in the past, relieve the works from a considerable amount of waste, but the demands of the fire

rtment are increasing with the growth of the city, and the increased ency of that department, to such an extent that the pumping nes are frequently called upon to deliver a quantity of water ely beyond their capacity, and which requires them to be run at a d which is dangerous to their safety. It would take but a slight lent at a critical moment, with everything running to its maximum city, to leave the city without a water supply for an indefinite od; and even without accident, and under the most favorable con- ns, it is at present impossible to furnish a satisfactory supply at all s to reasonable demands of the fire department. If that department riven to the use of steam fire engines to procure the necessary pres- to extinguish fires, it will still be necessary to procure additional ping machinery, as the water works will be required to furnish r for supplying steamers, and about the same quantity will have to umped, but at a lower pressure. The rotary pumps are fast ap- ching a condition of absolute uselessness, and unless immediate n is taken toward securing additional pumping machinery, it will necessary to replace them. This cannot be done with the present ping capacity without hazarding the fire protection of the city; if a of any magnitude should occur while these pumps were being taken and before others were in their place, it would be impossible for the n engines alone to supply the demand.

As a matter of economy only, it is advisable to secure new and roved machinery, the difference in cost of fuel alone, for pumping same quantity of water we are now delivering, would be more than cient to pay the interest on the cost of a pumping engine of 4,000,000 ons daily capacity. It is of vital importance to the efficiency and ty of the works, that additional pumping machinery of not less than above mentioned capacity, be procured as soon as practicable, and o other means can be devised to secure them the question should be mitted to the electors at the coming spring election, whether the should be bonded to secure this and other needed improvements rred to in this report.

The neighboring cities of Saginaw and East Saginaw, each of ch erected water works about the same time as this city, and with same pumping capacity as that now in use in these works, have

largely increased their capacity in this direction. Saginaw, with a population less than one-half of this city, and but very few water consumers, has had a 4,000,000 gallon pumping engine in operation more than a year, and East Saginaw placed a 6,000,000 gallon engine in its works about three years ago.

Main Pipes.

No extensions of the mains and distributing pipes in the city have been made during the year. The only change in the length of pipes connected with the works from that of last year being that rendered necessary by changing the location of four hydrants; the changes consisted in laying twelve feet of four-inch castiron pipe and taking out seven and one-half feet of four-inch Wyckoff pipe. One four-inch valve has been set in four-inch pipe leading to hydrant on the corner of Lee and Annie streets.

Total length of main pipes connected with the works Dec. 31, 1885:

	Miles.	Feet.
30-inch stave pipe from bay	4	66
18-inch stave pipe from river		386
Total stave pipe	4	452

Distributing mains:

	16-in.	12-in.	10-in.	8-in.	6-in.	4-in.	3-in.	Total.
Cast iron	1,410	4,883	8,475¼	1,938¾	989½	676½		18,372
Wyckoff patent			10,600¾	13,217½	55,576¼	19,267	319	98,980
Totals	1,410	4,883	19,076	15,155¼	56,565½	19,943½	319	117,352

	Miles.	Feet.
Total cast iron pipe	3	2,532½
Total Wyckoff patent pipe	18	3,940½
Total distributing mains	22	1,193

Valves in use:

30-inch valve in inlet from bay	1
18-inch valve in inlet from river	1

In distributing mains:

	16-in.	12-in.	10-in.	8-in.	6-in.	4-in.	3-in.	Total.
Flower's patent	1	3	11	28	78	175	3	299
Galvin's patent						11		11
Brown's patent		1			1			2
	1	4	11	28	79	186	3	312

Fire hydrants:

Holly's patent	118
Matthew's patent	41
Brown's patent	1
Total	160

There exists a very urgent necessity for a material increase in the ributing mains leading from the pumping station to the business ion of the city, in addition to that necessary to connect up the l ends as mentioned in my last annual report. A 16-inch main ling from the pumping station through the heart of the city, will be ecessity in a few years; but to meet the present demands, and to rd against a total loss of supply to the city in case of breakage to single main pipe at present leading from the engine house, there uld be a 12-inch main laid up Trumbull street from the pumping ion to Center street, with connections across to the present system Woodside avenue and Second street, and connecting into the present em at Center street. A 16-inch main on Water street from the nping station to Washington street, and on Washington street from ter street to Tenth street, will cost about $25,000 and will do more ards increasing the fire pressure in the business portions of the city n would a number of smaller pipes distributed through the rear por- of the city, but it would not give fire protection or water supply to portion of the city not in reach of the present system. A 12-inch e on Washington street from Tenth to Twelfth, on Twelfth from shington to Bowery, and on Bowery from Twelfth to Fremont nue, with a 10-inch pipe on Fremont avenue from Bowery to connect h the present system on Broadway; also a 10-inch pipe on Jennison nue from Fremont avenue to Thirty-eighth street, thence on Thirty- hth street to Ingraham street, on Ingraham street to McGraw avenue, nce west on McGraw avenue to connect with the present 8-inch main Harrison street, will cost an additional $25,000. With the main es as above described, and the pumping machinery increased in acity to a sufficient extent to supply that quantity of water, the ter works will be able to supply 3,500,000 gallons of water per day domestic use, and furnish the fire department with 12 effective fire ams in the heart of the city with a loss in pressure between the npping station and hydrants on Center street not exceeding 20 lbs.

per square inch; and with the same quantity of water being supplied to the city for domestic use, 10 effective fire streams can be furnished in the Seventh ward south of South Center street with a loss in pressure of about 40 lbs. per square inch between the engine house and the hydrants in that part of the city.

There have no leaks occurred in the iron pipe during the year. Nnmber of leaks in Wyckoff pipes, 18, of which 14 were in joints, 2 were caused by broken bands and 2 were knot holes. The expense for repairing these leaks, including new pipe for two of them, was $81.46. The most serious break was in the 10-inch main on Water street near Nineteenth street, where a large portion of the entire expense of repairs was incurred in relaying pavement washed out by water from the break.

The severe weather of January, February and March caused a great amount of trouble with the fire hydrants, 62 of which were at different times during those months found by employes of the Board either frozen or in such condition as to have delayed the fiemen in procuring water from them in case their use had been required at that certain time. Eight broken hydrants have been repaired, and four hydrants have been drained by leading sewers from their base to the public sewers. Ten service connections have been found leaking and repaired, and four service pipes have been found leaking between the main and shut off; these leaks have been repaired without charge to the consumer. The main pipe on the sonth side of Center street near Lincoln street has been raised to make way for sewer leading into Center street lateral.

Water Meters.

The number of water meters set during the year was 117, of the following sizes and styles:

Style.	Size.							
	2-in.	1½-in.	1-in.	¾-in.	⅝-in.	½-in.	⅜-in.	Total.
Union Rotary	2	1	1	1	4			9
Union Duplex					2			2
Crown		1	20	30		27	1	79
Empire			6	10		4		20
Worthington	2	5						7
	4	7	27	41	6	31	1	117

Meters taken out during the year:

Style.	Size.					
	2-in.	1½-in.	1-in.	¾ in.	⅝-in.	Total.
...n Rotary.....		2	1	1		4
...rn.....			1		1	2
...thington.....	1					1
	1	2	2	1	1	7

Whole number of meters now connected with service pipes:

Style.	Size.									
	8-in.	4-in.	3-in.	2-in.	1½-in.	1-in.	¾-in.	⅝-in.	½-in.	⅜-in.	Total.
...n Rotary.....	1	5	18	5	3	2	1	3		—	38
...n Duplex.....								2		—	2
...rn.....					1	24	34		28	—	87
...lre.....						6	10		4	—	20
...thington.....				1	6						7
	1	5	18	6	10	32	45	5	32		154

Meters on hand December 31st, 1885:

Style.	Size.						
	3-in.	2-in.	1½. in.	1-in.	½-in.	⅜-in.	Total.
...n Rotary.....	1	1	1	1			4
...rn.....				1		1	2
...lre.....					6		6
...thington.....		1					1
	1	2	1	2	6	1	13

Of the meters now in use, one hundred and thirty-one are on separate ...ices and meter rates are charged for the water passing through them.

Twenty-three are on sub-mains supplying a number of consumers, ... are test meters set temporarily for the purpose of determining ... necessity for metering the several branch services taken off from ...se sub-mains.

Of the meters taken out, 4 were replaced with smaller meters, the ... of water on the premises not warranting the use of as large meters ...were at first placed on the pipe, one was taken out by reason of not ...istering properly, and two were taken from services shut off.

Service Connections.

The number of service connections made with the main pipes during the year were 55, of the following sizes:

	1-in.	¾-in.	⅝-in.	½-in.	Total
With iron main pipes		3		3	6
With Wyckoff main pipes	7	6	24	12	49
Total	7	9	24	15	55

There has been taken out during the year, one 1-inch service connection in Wyckoff pipe, leaving whole number of service connections with main pipes at this date:

	8-in B	6-in B	4-in B	3-in B	2-in B	2-in.	1¼-in	1-in	¾-in	⅝-in	½-in	⅜-in	Total
Iron main pipes		2	9			2	6	43	54	31	78	5	2
Wyckoff m'n pipe	1	2	9	1	1	13		127	380	149	381		1
	1	4	18	1	1	15	6	170	434	180	459	5	1,2

Twenty-five branch services and 1,269 connections made with corporation cocks.

Ten services have been abandoned during the year and shut off at tap, the supply for the premises being taken from other services, and one branch service has no pipe connected with it, being plugged at the main.

Whole number of service connections shut off at main pipe and abandoned, 49. Leaving number of service connections in use, 1,24[illegible] through which are supplied 1,318 separate and distinct services, of which 1,057 are open and 261 are closed at stop-cock.

333 services have been shut off during the year. 103 for non-payment. 62 for leaks in service, 59 by request and 110 where the premises were found vacant.

300 services have been opened during the year.

Water Pumped and Cost of Pumping.

The quantity of water pumped during the year, as indicated by the revolutions of the pumps, was 836,970,046 gallons, an increase of about 5,000,000 gallons over the preceding year.

The records for the first half of the year show an increase of more n 23,000,000 gallons over the first half of 1884, while the last half of year shows a decrease of about 18,000,000 gallons from the last half 1884. This is due principally to the cutting off the waste of water on ices metered during the year.

Of the total quantity of water pumped, 824,922,128 gallons were npped against an average domestic pressure of 40 lbs. per square inch the level of the pressure gauge in the engine house, which is ivalent to a lift of 107 feet from the level of the water in the wells. 047,918 gallons were pumped against an average fire pressure of 7 lbs. per square inch, which is equivalent to a lift of 209 feet from level of the water in the wells.

The actual cost of running the pumping engines was as follows:

For fuel consumed	$3,556 75
For oil, packing, etc., used	426 71
For repairs to pumping machinery	356 36
For engineers' and firemen's wages	3,480 00
Total	$7,819 82
Making cost per million gallons pumped	$9 34
Cost per million gallons raised 100 feet	8 62
Cost of fuel per million gallons pumped	4 25—
Cost of fuel per million gallons raised 100 feet	3 92—

The greatest quantity of water pumped in one day, was February 2,991,602 gallons; least quantity pumped, Sunday, November 15th, 31,345 gallons.

The total quantity of water pumped each year as indicated by the volutions of the pumps is as follows:

	Gallons.		Gallons.
1873	142,477,725	1880	827,067,372
1874	294,714,798	1881	944,382,043
1875	416,756,579	1882	775,642,466
1876	518,197,129	1883	773,942,702
1877	538,847,186	1884	831,867,463
1878	580,197,397	1885	836,970,046
1879	672,344,128		



WATER PUMPED.

MONTH.	PISTON ENGINES & PUMPS.			ROTARY PUMPS.			TOTALS.		FIRE RECORD.					
	Hrs. Run.	Revolutions.	Gallons Pumped	Hrs. Run.	Revolutions	Gals. P'mp'd	Gallons Pumped	Daily Av'ge.	No. Al'ms	Hrs. Run.	High'st Pres're	Lowest Pres're	Av'ge Pres're	Gallons Pumped
January	742.50	1,408,781	77,482,955	8.50	19,151	383,020	77,865,975	2,511,805	7	3.52	80	60	77	704,085
February	672.00	* 1,360,983	73,498,457	29.07	98,230	1,964,600	75,458,057	2,694,930	8	10.09	90	70	85	2,191,610
March	739.04	* 1,439,278	78,223,640	8.42	50,703	1,014,060	79,237,700	2,556,005	7	3.23	80	70	79	665,640
April	712.18	* 1,229,059	65,829,177	9.04	53,600	1,072,000	66,901,177	2,230,039	7	3.57	100	80	91	621,675
May	740.57	1,216,941	66,931,755	5.31	30,147	602,940	67,534,695	2,178,538	21	10.57	90	60	82	1,647,880
June	719.40	1,290,589	70,982,395	1.20	7,374	125,358	71,107,753	2,370,258	12	3.50	110	80	86	686,575
July	742.55	1,387,026	76,286,430	4.44	24,881	422,977	76,709,407	2,474,497	17	9.32	85	70	80	1,638,714
August	740.37	* 1,305,188	71,424,161	5.28	29,946	509,082	71,933,243	2,320,427	12	8.29	80	70	76	1,282,304
September	717.20	* 1,207,652	66,031,100	3.20	18,999	322,983	66,354,083	2,211,802	9	2.58	100	70	86	471,840
October	742.10	* 1,184,741	64,416,417	2.50	16,358	278,086	64,694,503	2,086,919	12	2.59	80	70	78	357,940
November	717.15	999,360	54,964,800	2.45	15,601	265,217	55,230,017	1,841,000	5	1.05	80	80	80	118,250
December	743.25	1,154,583	63,502,065	5.30	25,963	441,371	63,943,436	2,062,691	9	11.03	100	70	88	1,661,505
Totals	8730.31	15,184,181	829,568,352	82.11	390,953	7,401,694	836,970,046	2,293,068	126	72.14	110	60	82.7	12,047,918

* February—99,166 revolutions: 3 pumps.
* March—72,060 revolutions; 3 pumps.
* April—126,392 revolutions; 3 pumps.
* August—27,783 revolutions: 3 pumps.
* September, 27,840 revolutions, 3 pumps.
* October—58,167 revolutions; 3 pumps.

Receipts.

Cash receipts for 1885 have been as follows:

From water rates, roll of 1880	$ 2 50	
" " " " 1881	24 00	
" " " " 1882	5 25	
" " " " 1883	22 92	
" " " " 1884	219 10	
" " " " 1885	19,551 59	
Total from water rates		$19,825 36
" plumbers' licenses		45 00
" rent of dock and boom		125 00
" repairs and care of hydrants, etc		5 00
" sale of service taps		192 50
" sale of service stop boxes		19 25
Total		$20,212 11

Deposited with city treasurer to the credit of water works fund:

January 31st	$2,687 02
February 28th	861 18
March 31st	844 56
April 30th	2,639 68
May 30th	1,142 56
June 30th	943 90
July 31st	2,332 08
August 31st	1,228 30
September 30th	1,048 05
October 31st	3,194 46
November 30th	1,435 56
December 31st	1,854 76
	$20,212 11

The amount of cash receipts as compared with 1884 show an crease of $225.95. The increase in amount collected for water rates s $347.68, showing a decrease in receipts from other sources of 21.73. This is due to the less number of new services put in; the ceipts from sale of service taps being $154.50 less than for 1884.

The amount collected for water rates on the roll of 1885 was 9,551.59, and the amount uncollected at the close of the year on that l was $431.34, making total amount charged on roll $19,982,93; an crease of $958.27 over total amount charged on roll of 1884.

The amount charged at assessment rates was $14,494.93, and ount charged for metered water $5,488.00.

EXPENDITURES.

The disbursements for the year 1885 have been as follows:

For office expenses, including chemical analysis of supply	$1,076 70	
treasurer's salary, July 1st, 1884, to December 31st, 1885	150 00	
superintendent and secretary's salary	1,800 00	
repair and care of hydrants, valves and pipes	737 12	
repairs to water meters	127 84	
repairs to inlet from bay	7 54	
repairs to breakwaters and reservoir	756 69	
care of reservoir at bay	254 38	
repairs to engine house	110 35	
repairs to engine foundations	37 96	
implements used on repairs	98 42	
Total maintenance except pumping		$5,157 00
For engineers' and firemen's wages	3,480 00	
fuel account	3,566 25	
oil, packing, and engineer's supplies	520 29	
repairs to pumping machinery	356 36	
Total pumping expenses		7,922 90
Total maintenance account		$13,079 90
For valves	9 36	
laying pipe	8 80	
house at bay shore	96 33	
breakwaters at bay (stone filling)	342 87	
water meters	3,452 29	
Total for construction account		3,909 65
For service tap account		91 25
Total disbursements		$17,080 90

DETAILS OF EXPENDITURES.

For office expenses:

Clerk hire	$520 00	
Postal cards and postage stamps	60 25	
Blank receipts, notices, etc	29 25	
Printing rules	4 75	
Blank assessment roll and record blanks	11 75	
Stationery, envelopes, ink, pens, etc	11 45	
Record, account and memorandum books	15 70	
Publishing report for 1884	55 25	
Accountant, examining books of 1884	29 25	
Rent of telephone	40 00	
Coal, repairs and cleaning office	45 81	
Binding two volumes report	2 00	
Exchange on drafts	5 19	$ 830 65
Dr. A. B. Prescott, for water analyses	210 00	
Procuring samples for analysis	11 00	
Vessels for transmitting samples	15 85	
Express charges on samples	9 20	246 05
		$1,076 70

For salaries:

Superintendent and secretary's salary for 1885	$1,800 00	
Treasurer's salary, July 1st, 1884, to January 1st, 1886	150 00	$1,950 00

For repairs and care of hydrants, valves and pipes:

Labor repairing 18 leaks in Wyckoff pipe	$ 67 63	
Sleeves and pipe for same	18 83	
Labor repairing service taps and service pipes	39 13	
Moving hydrants and changing grade of pipe for sidewalks and sewers	22 61	
Examining, testing and repairing hydrants	390 86	
Shop repairs to hydrants and valves	33 54	
New valve for street sprinkler hydrant	3 25	
Leather for hydrant valves	14 75	
New valve stems	12 70	
Repairs to valve cases	6 52	
Labor turning on and shutting off services	182 98	
Cleaning wells	9 37	737 12

For repairs to water meters:

Repairs on Crown meter, and freight and cartage	$ 6 38	
Repairs on 3 Rotary meters, freight and cartage	52 72	
Labor cleaning 37 meters	39 32	
Labor changing meters	6 76	
Repairs to meter connections	6 47	
Protecting meters from frost	16 19	127 84

For repairs to inlet from bay:

Labor and material for raising man-hole No. 3 to grade	$ 6 94	
Fastenings for covers	60	7 54

For repairs to breakwaters at bay—and reservoirs:

White oak piles	$ 200 50	
Driving 206 piles	251 00	
4,380 feet white oak plank	61 32	
260 lbs. boat spike	11 50	
Labor on breakwaters and reservoir banks	213 62	
Removing old work	18 75	756 69

For care of reservoir and inlet works:

Labor cleaning banks and inlet cut, and removing drift-wood,		254 38

For repairs to engine house and out-buildings:

Repairing brick work	$ 7 28	
Lumber and nails for engine house floor	26 16	
Labor repairing floor	9 00	
Paint and glass	6 80	
Floor in tool shed	20 02	
Extending sewer at engine house	32 95	
Sidewalk at engine house	8 14	110 35

For repairs to engine foundation:

Cast iron girder under rotary pump	$ 28 21	
Labor putting on girder	9 75	37 96

For implements used on repairs:

Repairing picks, chisels and street tools	$ 9 25	
2 Stillson pipe wrenches	6 86	
2 wrenches and hydrant keys	6 02	
New tools for street work	24 65	
Files, hammers, etc., for engine house	22 10	
Shovels, axes, saws, etc., for work at bay	29 54	98 42

For salaries of engineers and firemen:

First engineer's salary for 1885	$1,200 00	
Second engineer's salary for 1885	960 00	
Two firemen's salaries for 1885	1,320 00	3,480 00

For fuel account:

Paid Dolsen, Chapin & Co. for 3,566¼ cords slabs and edgings at 70 cents	$2,496 37	
Delivering same at engine house	1,069 88	3,566 25

For oil, packing and engineer's supplies:

Cylinder oil and grease	$ 108 49	
Lard oil	5 00	
Rubber, cotton and hemp packing	56 83	
Red lead, oil, bolts, rivets, etc	10 72	
Compound for cleaning boilers	145 83	
Wipers, tripoli and cleaning material	58 14	
Kerosene oil, chimneys, wicks, etc	59 69	
Grease cups, hose and ice	75 59	520 29

Repairs to pumping machinery:

Repairs on main piston engines	$ 20 77	
Repairs to air pump	16 96	
Repairs to piston pumps (labor)	6 62	
Repairs to reserve engine	24 21	
Repairs to rotary pumps and new counter for same	31 01	
Paint	9 65	
Repairing boilers—boiler makers	111 08	
Grate bars and inspection	92 52	
Gas pipe, fittings, valves, gauge-cocks, etc	43 54	356 36

For valve account:

One 4-inch valve and case for same		9 36

For laying pipe:

Labor putting in valve on hydrant branch	$ 4 19	
Labor putting in 12 feet of 4-inch pipe on hydrant branch	4 61	8 80

For house at bay shore:

Plastering and painting	$ 57 61	
Glass and screens	1 57	
Out-house and sheds	37 15	96 33

For breakwaters at bay:

64¼ cords of stone		342 87

For water meters:

115 new meters, freight and cartage	$2,758 01	
Lumber and nails for 88 boxes	136 34	
Iron covers	69 51	
Labor setting 117 meters	312 92	
Plumber's work and pipe fittings	167 73	
Draining 5 meters	7 78	3,452 29

For service taps:

6 dozen corporation stops	$ 52 60	
Labor inserting corporation stops	38 75	91 35

Balances.

The balance in the water works fund January 1st, 1885, was		$10,829 62
Collections deposited with the city treasurer to be credited to that fund,		20,212 11
Total credit water works fund		$31,041 73
Amounts withdrawn from water works fund by requisitions on the city recorder:		
1885.		
January 31st, requisition No. 191	$1,000 00	
February 27th, " " 192	1,200 00	
March 30th, " " 193	1,200 00	
April 30th, " " 194	2,500 00	
May 28th, " " 195	1,400 00	
June 29th, " " 196	1,200 00	
July 29th, " " 197	1,800 00	
August 29th, " " 198	1,800 00	
September 29th, " " 199	1,250 00	
October 31st, " " 200	1,400 00	
November 28th, " " 201	1,200 00	
December 31st, " " 202	1,350 00	
Total withdrawn		17,300 00
Balance in the water works fund December 31st, 1885		$13,741 73
An increase for the year of	$2,912 11	
The balance in the hands of the treasurer of the Board January 1st, 1885, was		$ 456 39
Amount withdrawn from water works fund and deposited with said treasurer		17,300 00
Makes total amount charged to treasurer of Board		$17,756 39
Amount of orders drawn on the treasurer by the secretary		17,080 90
Balance in the hands of the treasurer of the Board December 31st, 1885, besides outstanding orders		$ 675 49
An increase of	219 10	
Makes total increase in cash subject to the order of the Board	$3,131 21	

The following balance sheet shows the balance of each account from the commencement of the works to December 31st, 1885, as it appears on the ledger at that date:

LEDGER BALANCES DECEMBER 31ST, 1885.

		Debit.	Credit.
lo	488, Interest, discount and commissions	$ 4,224 17	
	488, Insurance account	29 00	
	487, Traveling expenses	306 29	
	487, Engineering and superintendence	7,856 17	
	487, Implement account	1,713 61	
	477, Furniture and fixtures	646 93	
	482, Real estate	6,724 83	
	482, Dock, tramway and store shed	1,882 63	
	482, Engine house, chimney and wells	19,097 42	
	483, Engine foundations, boiler foundations and arches	4,931 72	
	483, Inlet from Saginaw river	3,218 99	
	483, Inlet from Saginaw bay	84,778 37	
	480, Reservoir, breakwaters and filters at bay	24,073 28	
	480, Pumping machinery	39,471 07	
	479, Iron pipe and branch castings	53,068 91	
	479, Wyckoff pipe	77,008 46	
	477, Laying pipe	34,056 19	
	478, Valves for street mains	9,183 77	
	478, Public fire hydrants	8,022 74	
	488, Buildings at bay shore	374 13	
	476, Water meters	9,372 44	
	412, Office expenses and salary account	25,078 81	
	416, Repairs and care of hydrants, valves and pipes	7,457 41	
	416, Repairs to reservoir and breakwaters	4,279 27	
	421, Repairs to inlet pipe from bay	17 94	
	417, Repairs to water meters	187 38	
	412, Engineers' and firemen's wages	45,512 84	
	413, Fuel account	36,909 61	
	413, Oil, packing and engineer's supplies	5,527 64	
	414, Repairs to pumping machinery	3,906 58	
	414, Repairs to boiler arches	664 08	
	415, Repairs to engine house, and insurance	683 12	
	421, Repairs to engine foundations	37 96	
	415, Repairs to dock	13 38	
	417, Implements on repairs, and tools	950 62	
	498, Water works fund	13,741 73	
	493, Orrin Bump, treasurer	675 49	
	491, A. L. Stewart	15 00	
	491, Thomas Rosa	15 57	
	408, Water rates, rolls of 1872-3 to 1880		$74,456 96
	410, Water rates, roll of 1881		14,086 61
	418, " " " 1882		17,325 27
	418, " " " 1883		18,699 13
	419, " " " 1884		18,886 22
	419, " " " 1885		19,551 59
	411, Plumbers' licenses		312 70
	411, Rents, dockage, etc		1,002 33
	493, Service tap account		1,645 85
	476, Service stop box account		6 95
	481, Bay City bond account ($377,000 bonds)		$368,045 87
	481, Water assessment, frontage on pipe		736 07
		$535,715 55	$535,715 55

Water Rates for 1886.

The assessment rates for 1886 amount to $12,657.00, which i $3,053.00 less than the assessment rates for 1885 at the commencemen of that year; but $2,966.00 of assessment rates for 1885 are no supplied through meters, making assessment roll for 1886 in realit $87.00 less than roll for 1885. This reduction is due to the larg number of services shut off late in December for non-payment of wate rates, and which had not paid up and been opened on the first da of January.

The assessment rates for 1886 are for the following uses:

1 Armory.
1 Ashery.
6 Bakeries.
15 Barber shops.
4 Bath rooms.
163 Baths (private).
1 Bath (Turkish).
2 Billiard rooms.
5 Blacksmith shops.
6 Boarding houses.
5 Bottling works.
2 Business Colleges.
6 Butcher shops.
3 Banks.
1 Candy factory.
2 Carriage shops.
4 Churches.
2 Cigar factories.
2 Clothes cleaning.
1 Coffee roaster.
1 Cooper shop.
1 Cracker factory.
2 Creameries.
605 Dwellings.
1 Express office.
1 Furniture factory.
94 Families in blocks.
3 Gas engines.
1 Gas works.
1 Green house.
1 Gun shop.
7 Halls.
2 Harness shops.
263 Hose for sprinkling.
1 Hospital.
26 Hotels.
3 Laundries.
1 Machine shop.
1 Motor.
1 Paint shop.
6 Photograph galleries.
1 Passenger depot.
4 Planing mills.
2 Plumbers shops.
1 Reel factory.
3 Roller rinks.
9 Restaurants.
2 Refrigerators.
87 Saloons.
1 Salt crusher.
6 Schools.
1 Stone yard.
1 Soap factory.
1 Slaughter house.
1 Shingle mill.
7 Stables (livery).
10 Stables (mill).
115 Stables (private).
78 Stores.
1 Tailor shop.
1 Telegraph office.
1 Telephone exchange.
522 Water closets.
1 Wood yard.
48 Water closets in schools.

The following uses are supplied through meters:

Boarding house.
Boiler shop.
Brewery.
Building purposes.
Business blocks.
Coal and wood yard.
Cooper shop.
County jail.
County court house.
Creamery.
Drill houses.
Dwellings.
Electric light works.
Feed store.
Flour mill.
Green house.
Hotels.
Laundry.
Livery stables.
Machine shops.
5 Offices.
1 Pipe works.
7 Planing mills.
2 Printing offices.
2 Passengers depots.
1 Restaurant.
15 Salt blocks.
15 Saw mills.
8 Stables (mill).
1 Stable (street car).
1 Wooden ware works.
20 pipes on which hydrants are located for fire protection.
16 Private baths.
115 Water closets.
8 Private stables.
2 hotel stables.
2 Round houses and tanks for locomotive use.

The following are supplied free of charge to the several departments of the city government:

1 City building, police station and city offices.
6 City hose and truck houses and stables.
1 City library building.
2 Ornamental fountains in public square.
7 Public drinking fountains.
Hose for sprinkling public parks.
11 Water closets and urinals in city buildings.

The water supply is shut off from premises as follows:

Barber shops.
Blocks.
Boarding houses.
Butcher shops.
Cigar factory.
Coal yard.
Drill houses.
24 Dwellings.
Elevators.
Factory.
Hydrant pipes.
Hotels.
Hose for sprinkling.
1 Office.
1 Planing mill.
1 Market garden.
3 Saw mills.
2 Salt blocks.
2 Shops.
1 Slaughter house.
11 Stables.
15 Stores.
5 Saloons.
37 Vacant lots.
5 Buildings not completed.

The following table shows amount collected, amount uncollected, total charged on roll (including metered water) each year since the works commenced operations:

Year's roll.	Amount collected.	Amount uncollect'd	Total on roll.
1873, January 1st to April 30th	$ 728 82	$	$ 728 82
1873-4, May 1st to April 30th	5,440 80	1 60	5,442 40
1874-5, May 1st to April 30th	6,908 16	44 85	6,953 01
1875, May 1st to Dec. 31st	7,269 55	28 46	7,298 01
1876	9,571 26	82 73	9,653 99
1877	9,604 26	134 19	9,738 45
1878	10,078 15	324 71	10,402 86
1879	11,708 97	136 07	11,845 04
1880	13,146 99	134 00	13,280 99
1881	14,986 61	238 40	15,225 01
1882	17,325 27	196 05	17,521 32
1883	18,699 13	112 97	18,812 10
1884	18,886 22	138 44	19,024 66
1885	19,551 59	431 34	19,982 93
Total	$163,905 78	$2,008 81	$165 909 59

The books of the office for the year 1884 were examined in February, 1885. The report of the accountants making the examination is appended to this report.

Respectfully submitted,

E. L. DUNBAR,

Bay City, January 30th, 1886. Superintendent and Secretary.

Report of Accountants.

To the Honorable Board of Water Commissioners of Bay City.

Gentlemen:—We, the undersigned accountants, employed to examine the books and accounts of the Bay City Water-Works for the year 1884, would respectfully report as follows:

That we have carefully examined the records, vouchers, accounts and books of the secretary and found them correct.

We have also examined all assessment rolls and have compared the same with stubs of receipts, and find they agree with the daily record, also with the day book, and we find the ledger balances correct as per trial balance of the secretary, January 1st, 1885, in his thirteenth annual report, dated January 28th, 1885.

(Signed) Chas. F. Braman,

(Signed) Daniel A. Marshall,

Dated March 6th, 1885. Accountants.

METER LIST.

Name of consumer.	Use.	Size and style.		Cost, set.
McEwan Bros	mill, etc	3-inch	Rotary	$ 159 55
Dolsen, Chapin & Co	drill house	¾-inch	Crown	29 26
" " "	mill, etc	3-inch	Rotary	164 54
" " "	salt block	2-inch	"	105 61
Eddy Bros. & Co	mill, etc	3-inch	"	156 29
John Wald	dwelling, etc	¾-inch	Empire	24 15
Folsom & Arnold	mill, etc	4-inch	Rotary	270 15
" "	drill houses, etc	3-inch	"	155 32
Detroit mills	drill houses	¾-inch	Crown	47 19
" "	stable	¾-inch	"	
The Michigan Pipe Company	pipe works, etc	4-inch	Rotary	230 87
" " " " "		3-inch	"	133 38
C. Hiller	planing mill	¾-inch	Crown	27 32
E. Carter	hotel	½-inch	"	18 30
F. & P. M. Railroad Company	locomotives, etc	1-inch	"	68 94
" " " "	passenger depot	¾-inch	"	
Bay City Iron Company	machine shop	1-inch	"	37 24
Louis Cormier	hotel	½-inch	"	17 33
M. C. Railroad Company	locomotives	2-inch	Worthington	67 47
" " "	passenger depot	¾-inch	Crown	25 20
Pitts & Cranage	planing mill, etc	3-inch	Rotary	127 18
" "	mill, etc	4-inch	"	243 21
" "	salt block	3-inch	"	132 27
George Ford	machine shop	¾-inch	Crown	33 35
Schucker & Hopp	block	¾-inch	"	28 95
Wolverton House	hotel	¾-inch	"	28 44
C. A. Jay	hotel	½-inch	Rotary	104 09
" "	hotel	¾-inch	Crown	
" "	hotel	½-inch	"	
" "	hotel	¾-inch	"	
Peter LaFrance	livery stable	¾-inch	"	31 26
Wm. McEwan	closets at block	½-inch	Rotary	18 75
Bay City Tribune	printing office	¾-inch	Crown	29 15
Becktel & Sons	hotel	¾-inch	"	29 07
E. E. Burroughs	livery stable	½-inch	"	18 66
A. N. Rouech	hotel	1-inch	"	36 31
Mrs. H. S. Benson	Watson block	¾-inch	"	43 90
" " "	Watson block	½-inch	"	
L. H. Griffin	laundry	¾-inch	"	25 65
" "	printing office, etc	½-inch	"	17 65
Henry Birney	livery stable	¾-inch	"	27 85
Geo. Schindehette	hotel	¾-inch	"	34 81
H. Tupper, M. D	dwelling	¾-inch	"	62 56
" " "	stable	½-inch	"	
Geo. Cooke	hotel	1-inch	"	42 79
R. J. Parker	hotel	½-inch	"	22 12
Wm. P. Root	hotel	¾-inch	"	29 77
James Shearer	Central block	1½-inch	Worthington.	53 78
Shearer Bros	block	1½-inch	Rotary	48 72
Bay County	court house	1-inch	Crown	52 14
Jas. B. Shearer	dwelling	½-inch	"	25 02
B. E. Warren	dwelling	¾-inch	"	35 42

T. E. Webster	dwelling	¾-inch	"	17 97
Episcopal society	building church	½-inch	"	14 87
John Drake	dwelling	⅝-inch	Duplex	18 14
C. H. Shearer	dwelling	¾-inch	Crown	25 69
C. A. Eddy	dwelling, etc	¾-inch	"	28 85
C. H. Bradley	dwelling, etc	¾-inch	Empire	29 37
N. Dunham	dwelling, etc	⅜-inch	"	25 02
H. Griswold	dwelling	½-inch	Crown	14 47
Jas. McKeon	dwelling	¾-inch	Empire	14 58
Bay County Milk Association	creamery	¾-inch	"	20 70
Private main, Johnson and Fifth		1-inch	Crown	36 13
" " Sheridan and Center		2-inch	Rotary	71 29
" " Sherman and Center		1-inch	Crown	37 57
" " Center, bet. Sherman and Farragut		1-inch	"	36 89
" " Fifth and Grant		1-inch	"	36 25
" " Fourth and Grant		¾-inch	"	28 04
" " " "		1-inch	"	36 25
J. F. Antisdel	hotel	1-inch	Empire	
" "	hotel	¾-inch	Rotary	96 09
" "	hotel	1-inch	Crown	
Hurley Bros	printing office	¾-inch	"	22 30
A. B. Paine	block	¾-inch	"	14 87
Mrs. C. B. Cottrell	block	⅝-inch	Rotary	20 45
Young Bros	coal yard	¾-inch	Empire	27 70
Joe Mills	livery stable	½-inch	Crown	18 73
Palace Stables	livery stable	¾-inch	"	28 90
S. G. M. Gates	office	½-inch	"	20 49
" "	mill, etc	3-inch	Rotary	126 35
Gates & Chatfield	flour mill	¾-inch	Empire	25 94
S. G. M. Gates	stable	¾-inch	"	28 77
F. E. Bradley & Co	mill, etc	4-inch	Rotary	238 32
Swift Electric Light Company	electric light works	1½-inch	Worthington	52 10
National Boiler Works	boiler shop	¾-inch	Crown	18 36
J. Bammill & Co	planing mill	⅝-inch	Empire	20 34
S. M. Green	dwelling	¾-inch	"	26 59
Peter Kelson	hotel	¾-inch	Crown	21 42
John McDermott	block	¾-inch	Empire	20 47
John Conroy	hotel	¾-inch	"	27 09
A. Vandenbrooks	water closets at bl'k	¾-inch	Crown	24 80
Bay County	county jail	¾-inch	"	32 40
Wm. McEwan	dwelling	¾-inch	Empire	20 72
" "	stable	½-inch	Crown	19 77
R. W. Erwin, M. D	dwelling, etc	¾-inch	Empire	25 27
John Thompson	dwelling	½-inch	Crown	19 41
Geo. Young	dwelling	¾-inch	"	28 45
F. W. Bradley	dwelling	⅝-inch	Duplex	18 28
Mrs. A. Beckwith	dwelling	½-inch	Crown	16 57
W. I. Brotherton	dwelling	¾-inch	"	14 61
S. T. Holmes	stable, etc	1½-inch	Worthington	54 31
J. K. Mason	dwelling	½-inch	Crown	14 87
John McEwan	dwelling	½-inch	"	17 38
Chas. Breitmeyer	green house	¾-inch	"	28 70
Private main, Center bet. Hampton and McClellan		1-inch	"	38 06
" " Center and Sheridan		1-inch	Empire	31 69

Private main,	Eighth and Farragut	1-inch	Crown		36 72
" "	east side Grant bet. 8th and 9th	1-inch	"		42 33
" "	Eighth and Grant	1-inch	"		37 16
" "	Seventh bet. Jackson and VanBuren	1-inch	Empire		36 04
Westover block		1-inch	"		36 04
Eddy, Avery & Eddy	hydrants	3-inch	Rotary		126 25
" " "	drill houses	¾-inch	Crown		29 09
" " "	mill	¾-inch	"		29 10
" " "	mill, etc	3-inch	Rotary		132 75
Smalley Bros. & Co	machine shop, etc	3-inch	"		122 72
McKinnon Manufacturing Co	machine shop	¾-inch	Crown		25 63
Industrial Works	machine shop	3-inch	Rotary		130 56
Jas. Clement & Sons	office	1-inch	"		27 25
Wm. Peter	mill, etc	3-inch	"		132 25
N. B. Bradley & Sons	mill, etc	3-inch	"		132 90
Matthew Lamont	hydrant	1¼-inch	Worthington		79 52
" "	planing mill	¾-inch	Crown		
High School	school	1-inch	Empire		32 99
Ross, Bradley & Co	planing mill	1½-inch	Crown		66 45
N. B. Bradley & Sons	drill houses	1¼-inch	Rotary		56 26
Private main,	Tenth bet. Saginaw and Washington	1-inch	Crown		38 88
" "	Eleventh bet. Wash'ton and Adams	¾-inch	"		29 07
" "	Tenth bet. Madison and Monroe	1-inch	Empire		36 72
" "	Thirteenth bet. Monroe and Jackson,	¾-inch	Crown		28 01
N. B. Bradley & Sons	drill houses	1¼-inch	Rotary		62 04
Butman & Rust	mill, etc	2-inch	"		78 08
" "	salt block, etc	1-inch	Crown		37 79
Rust Bros & Co	salt block,	1-inch	Rotary		40 30
" " "	mill, etc	3-inch	"		154 81
" " "	hydrant	4-inch	"		232 91
Bay City Brewing Company	brewery	1-inch	Crown		
" " " "	brewery	1-inch	"		111 20
" " " "	brewery	1-inch	"		
S. McLean, Son & Co	mill, etc	2-inch	Rotary		76 37
" " " "	office	½-inch	Crown		18 67
" " " "	salt block	1-inch	"		49 87
Standard Machinery Company	machine shop	¾-inch	"		28 52
B. H. Briscoe & Co	planing mill	1½-inch	Worthington,		49 75
Miller & Lewis	drill houses	1-inch	Crown		66 30
" "	salt block	¾-inch	"		
" "	mill, etc	3-inch	Rotary		186 22
C. R. Fancher & Co	hotel	1-inch	Crown		42 48
Bay City Street Railway Co	barn	1-inch	"		45 02
Bousefield, Perrin & Co	wooden ware work	3-inch	Rotary		115 65
Michigan Fire Lighter Co	fire lighter factory	1½-inch	Worthington,		49 21
R. M. Bradley	planing mill	3-inch	Rotary		118 05
Birdsall & Barker	mill, etc	8-inch	"		952 17
E. C. Lindsay	market garden	2-inch	"		66 23
Elevator indicator shut off				32 50	
Labor on 6 meters taken out				41 87	74 37
Fittings, covers, etc					85 30
Meters on hand					417 57
					$9,372 44

Material used in running pumping engines during the year 1885.

3,566¼ cords slabs and edgings	costing	$3,556 75
51 gallons carbolene valve oil	"	36 97
89⅓ gallons cylinder oil	"	59 74
20 lbs. Royal lubricant	"	5 00
4 gallons lard oil	"	4 00
1¼ lbs. plumbago	"	37
28¼ lbs. square rubber packing	"	20 92
1 air pump valve	"	6 18
4¾ lbs. sheet rubber	"	2 84
6 lbs. gaskets for boilers	"	2 75
12⅓ lbs. Heston cone packing	"	18 75
9 lbs. hemp packing	"	2 25
16½ lbs. cotton packing	"	6 60
35½ lbs. valve leathers	"	23 13
34 lbs. rivets	"	5 10
50 bolts	"	1 75
Red lead, etc	"	3 61
Sheet copper, etc	"	3 31
747 lbs. wipers	"	52 29
Tripoli, oxalic acid, etc	"	1 35
Emery cloth and brooms	"	2 65
505½ gallons kerosene oil	"	58 82
Chimneys and wicks	"	1 29
Concentrated lye and soda	"	29 40
358 lbs. scale eradicator	"	94 67
89 lbs. Eureka boiler compound	"	7 37
Hose, ice, grease cups, etc	"	75 50
		$4,083 46

Material on hand January 1st, 1886.

35½ cords of slabs and edgings	costing	$35 50
60 gallons cylinder oil	"	37 50
25 lbs. grease	"	6 25
½ lb. plumbago	"	12
2 gallons lard oil	"	2 00
10 lbs. 1-inch square rubber packing	"	8 50
1 lb. ¾-inch square rubber packing	"	60
1 air pump valve	"	3 20
11½ lbs. sheet rubber	"	4 60
20 lbs. boiler gaskets	"	10 00
13½ lbs. cotton packing	"	5 40
4½ lbs. Heston packing	"	6 75
6 lbs. hemp packing	"	1 50
43 lbs. British scale eradicator	"	10 75
413 lbs. Eureka boiler compound	"	33 04
10 lbs. valve leathers	"	3 50
52 lbs. wipers	"	3 64
3 lbs. tripoli	"	30
7 lbs. rotten stone	"	70
½ lb. oxalic acid	"	12
8 sheets emery cloth	"	32
5 lbs. red lead	"	50
25 gallons kerosene oil	"	2 12
5 brooms	"	1 00
50 lamp chimneys and 8 doz. wicks	"	....
		$178 93

FIFTEENTH

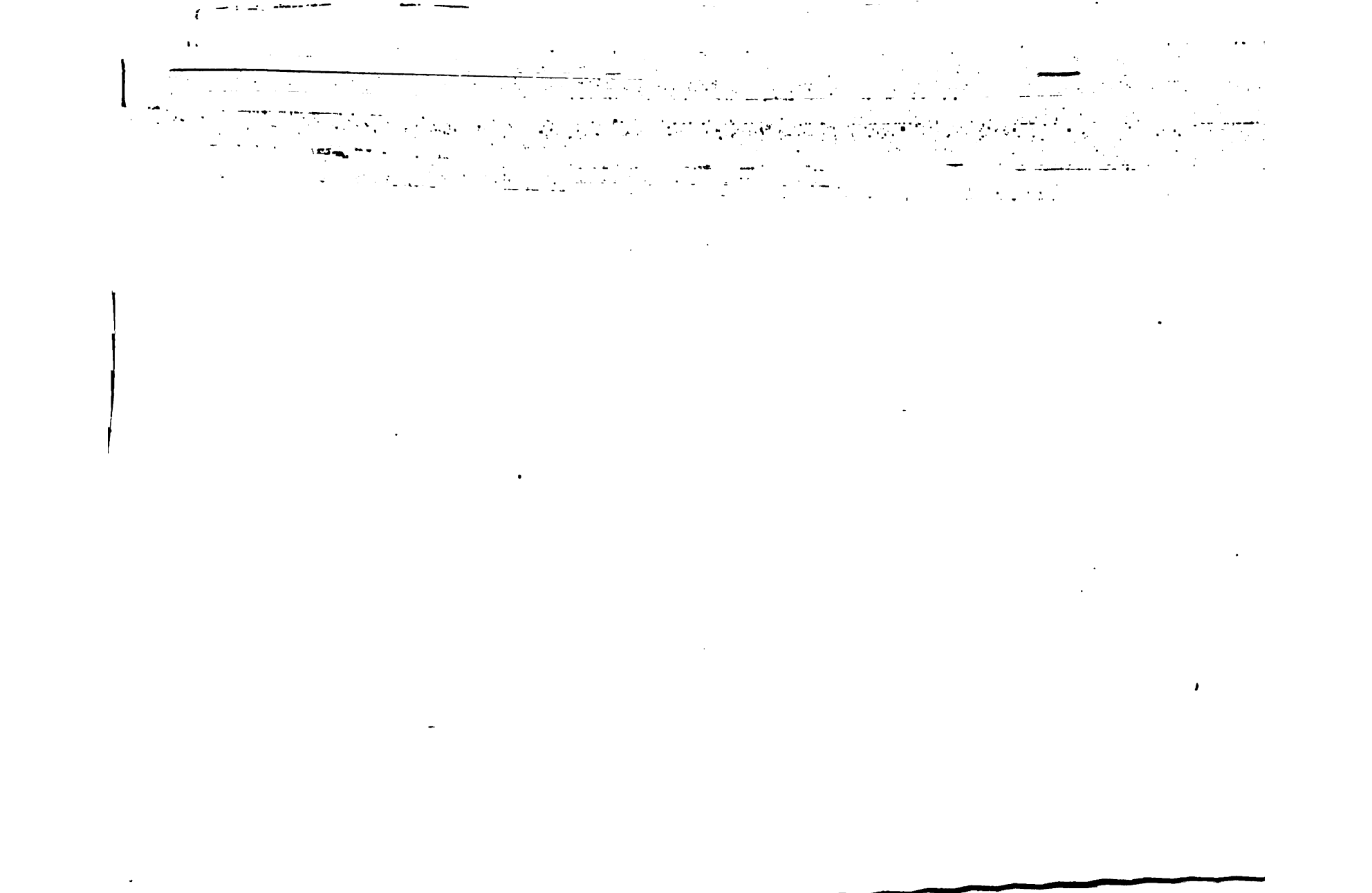
Annual Report

OF THE

Superintendent of Water Works,

BAY CITY, MICHIGAN,

FOR 1886.



FIFTEENTH

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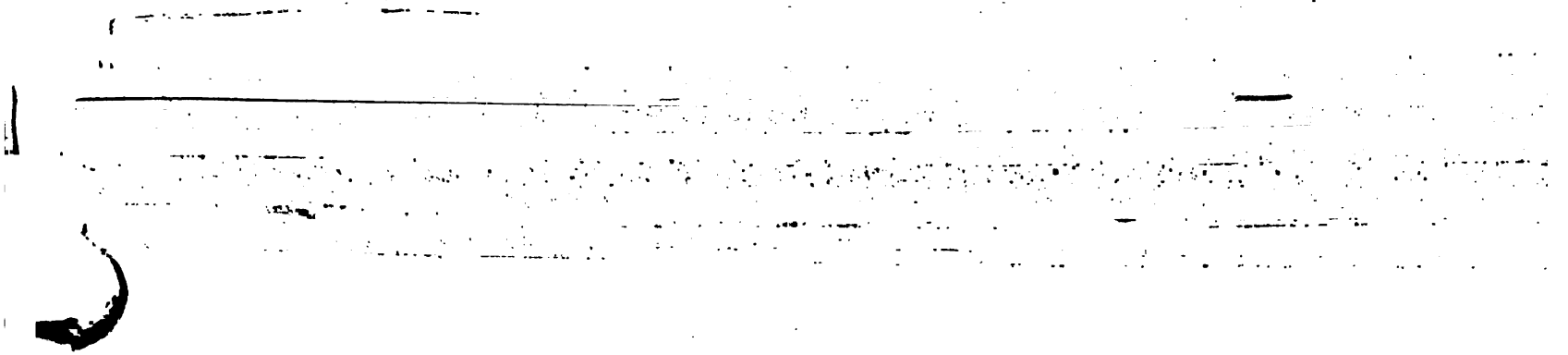
BAY CITY, MICHIGAN,

FOR 1886.

Compliments of

E. L. Dunbar, Supt.

PLEASE EXCHANGE.



FIFTEENTH

Annual Report

OF THE

Superintendent of Water Works,

BAY CITY, MICHIGAN,

FOR 1886.

Compliments of

E. S. Dunbar, Supt.

PLEASE EXCHANGE.

CITY OF BAY CITY, MICHIGAN.

Water Department.

1886.

Commissioners.

ANDREW WALTON, President.
(Term expires September 6th, 1887.)

G. HENRY SHEARER.
(Term expires September 6th, 1888.)

BENJAMIN F. RAY.
(Term expires September 6th, 1889.)

JOHN D. McKINNON.
(Term expires September 6th, 1890.)

ANDREW VAN DEN BROOKS.
(Term expires September 6th, 1891.)

DUNCAN McGREGOR.
(Term expires August 4th, 1889.)

GEORGE C. MEYERS.
(Term expires August 4th, 1890.)

Superintendent and Secretary, E. L. DUNBAR.

Office Assistant, THOMAS A. DELZELL.

Inspector and Foreman, FRANK H. COLLINS.

Reservoir Keeper, LEVI D. CARPENTER.

PUMPING DEPARTMENT:

A. B. VERITY.....First Engineer.
FRED H. HOLLY.....Second Engineer.
PATRICK O'HARE.....Fireman.
A. J. CARPENTER.....Fireman.

) THE HON. THE BOARD OF WATER COMMISSIONERS OF BAY CITY:

GENTLEMEN—I have the honor to submit herewith my fifteenth nual report as superintendent of the water works of this city; the re-rt covering the operations of that department for the year 1886.

The receipts of the office have been about $500 less than they ere for the preceding year. This decrease has been entirely in re-ipts from water rates, and is due to the reduction in rates charged for etered water; the maximum rate having been reduced from 20 cts. per 000 gallons to 10 cts. per 1,000 gallons, by an amendment to the city dinance fixing such rates, which amendment took effect February 15th, 86.

About 25,000,000 gallons have been supplied consumers in such uantities as under the old ordinance would have returned a revenue of 5 cts. to 20 cts. per 1,000 gallons, but which was supplied under the nended ordinance at 10 cts. per 1,000 gallons, making a difference of out $2,000 in the receipts. This sum added to the amount actually ceived would have shown a healthy increase over the revenue for the receding year, but there is a possibility that, had the rates remained nchanged, a few of the smaller consumers would have discontinued the se of water from the water works, or would have so reduced the uantity consumed as to reduce the amount paid by them to approxi-ately the same amount as was paid under the amended ordinance.

The expenditures of the board have been largely in excess of those or any previous year since 1875, when the principal work of construc-on was completed. The amount expended for maintenance has been rger than usual owing to the extensive repairs to the inlet works at ne bay, rendered necessary by the storm which occurred December 4th, 885, the effect of which was more particularly described in my last nnual report. These works are now in a more satisfactory condition an ever before, and with the addition of a few more stone in the break-ater will, in all probability, withstand the action of the elements for everal years without extensive repairs.

The pumping machinery has been placed in condition to meet the requirements of the city for several years, by the addition of a Gaskill pumping engine of 4,000,000 gallons daily capacity, the cost of which, however, does not appear in the actual expenditures of the board, as no payment is to be made on its purchase price until 1889.

The distributing mains have been materially extended, and the efficiency of the system greatly improved during the year. The danger of the city water supply being entirely cut off by accident to the single main pipe heretofore in use between the pumping station and business portion of the city has been removed by laying a 12-inch main in Trumbull street, from the pumping station to Second street, and in Second street from Trumbull street to Johnston street, where it connects with the 10-inch main, before laid, leading to Center avenue. A 10-inch main has been laid in Trumbull street from Second street to connect with the pipe already laid in Center avenue. Also a pipe of the same size in Second street from Johnson street, to connect with the old system at the alley between Jackson and Van Buren streets. An 8-inch pipe has been laid in Center avenue, north of the pavement, from Johnson street to Sheridan street, and a 6-inch pipe in the same street, from the alley between Jefferson and Madison streets to the alley between Adams and Jefferson streets. The lines of pipe above mentioned were laid mainly for the purpose of increasing the efficiency of the water service in all parts of the city, and particularly in the business portion, and to secure to a greater extent the benefits to be derived from the introduction of the additional pumping machinery. In addition to the lines of pipe before mentioned, the two dead ends in Fitzhugh street have been connected up by laying a 6-inch pipe in that street from Fifteenth street to Twenty-second street. A 4-inch pipe has been laid in Sixth, Adams and Seventh streets, around the east half of block 74. The construction of the new opera house across the pipe line running through the alley in said block having made it necessary to remove that pipe. The 6-inch pipe on the west side of Water street has been extended south about one half block from its former terminus near the south line of Sixth street, and 4-inch pipe lines have been laid to connect two new fire hydrants with old mains in Fitzhugh street, and in the alley between Saginaw and Washington streets, the hydrants being located respectively at the south-east corner of Twelfth and Fitzhugh streets, and the south-west corner of Fourth and Washington streets.

The completion of the several lines of pipe as noted, developed a
rked improvement in the pressure throughout the city, the increase
the pressure for domestic service being fully 5 lbs. per square inch,
indicated by the gauge in the water works office, and a corresponding
crease in the efficiency of fire streams was the result before the new
mping engine being brought into use permitted an increase in the
e pressure at the pumping station.

No fires have occurred since the new engines were fully completed
ich required more than six or seven streams to control them, and it
s not been considered advisable to subject the works for any consider-
le length of time to any unnecessary strain at this season of the year
account of the difficulty and expense of making repairs in case of
eakage to main pipes or services, therefore no tests have been made
her than those mentioned in connection with a more detailed state-
ent of the immediate causes and efforts which led to the completion
the above noted improvements, which appears under its proper head
d in a subsequent portion of this report.

The pipe mentioned as having been removed in block 74 was of
e Wyckoff patent, 6-inch bore, and had been in service since 1874.
hen taken out it was found to be in such good condition that it was
ken to the works of the Michigan Pipe Company, tested to a pressure
120 lbs. per square inch, recoated where the coating had been
nocked off in handling, new thimbles put in, and the pipe again laid
other lines. Only one short section out of the 332 feet of pipe taken
ut failed to stand the test, and this had been unnecessarily injured by
iling to properly secure one of the bands where it had been cut for the
urpose of inserting a service tap, and although it had stood the pressure
f actual service in this condition since 1875, it failed under the test
ressure noted.

The meter system has not been materially extended during the
ear, the work being mainly confined to attaching meters to such new
ervices as appeared to require it, and placing a few on old services
here requested by consumers or the exigencies of the case seemed to
emand.

Source and Quality of Supply.

The supply for the city has been taken entirely from Saginaw Bay

except for twenty-three hours and forty-three minutes, during which the river inlet has been partially open, the supply through the pipe leading from the bay not being sufficient to supply the demand.

The dates on which the river pipe has been called upon to re-enforce the supply have been as follows:

	Hours.	Minutes.
January 17th and 18th, Opera House fire	6	0
February 4th, fire at 818 North Madison street	1	58
May 17th, fire at Roberts' dock	4	0
May 19th, fire in barn foot of Saginaw street	0	20
September 10th, fire at corner of Eighth and Washington St.	1	0
November 12th, fire at Chatfield's flour mill	4	0
November 18th and 19th, supply cut off by ice	6	0
December 7th, testing engines	0	30
Total	23	43

During the six hours under date of November 18th and 19th the supply from the bay was entirely cut off by low water and the accumulation of ice at the pipe leading into the reservoir at the bay, and the supply for the city was drawn entirely from the river inlet during that time. The extreme range of the water level in the bay between the high water of December 4th, 1885, and the low water of November 18th, 1886, must have been fully 9 feet.

The quality of the supply has been better than for several previous years, there having been much less sediment in the water. This is due to some extent, to the more complete enclosure of the inlet works with stone-filled break-waters, and also to a considerable extent to the small amount of work done in the river in the way of dredging, there having been but little, if any, river dredgings deposited by the government contractors in the bay.

The inlet cut and banks have also been kept in better condition, and more free from drift wood and debris of all kinds than ever before, prompt attention having been given to the removal of any such matter as soon as it appeared.

Inlet Works at the Bay.

As noted in my last report the commencement of the year found the inlet works at the bay in a very dilapidated condition, having just passed through the most severe storm they had ever been called upon to encounter.

The work of making the necessary repairs was commenced in nuary, and pushed forward as rapidly as possible, and before the ice oke up in the spring the work was so far advanced that all danger of rther damage to the reservoir banks was passed. All of the main les had been driven, and that portion of the break-water in front of e most exposed portions of the reservoir planked and sheet piled. efore the opening of navigation in the spring proposals were invited r furnishing stone for filling the break-water. The lowest bid received as $6.50 per cord delivered on the bank, and all of the bids were omptly rejected, this being a higher price than had ever been paid, urchasing in cargo lots. The stone used were afterwards bought ithout advertising, the highest price paid being $6.00 per cord, and a ortion were bought at $5.50 per cord.

The work done during the year consisted of building 1,056 feet of reak-water complete, with double row of piles, inside row planked and eet piled, building 165 feet of break-water across banks with single w of piles, planked and sheet piled, and driving outside row of piles in ont of 510 feet of old single pile work.

The material used in making these repairs consisted of 723 new hite oak piles, 139 old white oak piles, torn out by the storm or pulled it with pile driver and redriven, 9,263 feet of white oak plank besides e plank carried away by the storm in 1885, most of which were re-overed in good condition and again used, 1,250 lbs. of boat spike and 08 cords of stone.

The piles, plank, and all material, except the stone, and all of the abor performed on this work has been charged to repairs to break-aters, and amounts to $2,462.36.

The cost of the stone for filling break-water, amounting to $640.50, as been charged in construction account.

The timber and pile work has been fully completed, but there hould be about 100 cords of stone placed in the break-water to render iem perfectly secure.

Pumping Machinery.

The fire which destroyed the Westover Opera House block on the ight of January 17th appeared to open the eyes of the public and of

the city council to a fact which has been repeatedly called to their attention by your honorable board, that some improvement in the fire service from the water works was required.

At the next meeting of the Common Council a resolution was adopted calling upon the water works committee of the Council for a report as to the cause for the lack of pressure from the water works at the time of that fire.

The committee submitted a report setting forth the necessity for additional pumping capacity and more main pipes leading from the pumping station to the business portion of the city.

At the same meeting of the Common Council a resolution was adopted calling upon your secretary to report to the Common Council what, in his opinion, would be necessary to make the water works more efficient, with the probable cost, and other information relating thereto.

At the same time a committee consisting of Aldermen Daunt, Gustin and Miller, was appointed to confer with the board of water works in regard to the works and report at the next meeting of the Common Council.

At the next regular meeting of the Common Council, held February 1st, your secretary submitted the report called for, giving, in detail, the improvements which, in his opinion, the works required.

The special committee of the Common Council, appointed to confer with the board of water works, met with the board at the water works office on the 15th day of February, and the whole matter was carefully examined into by that committee.

As a result of that conference the committee submitted a report to the Common Council February 22nd, recommending that immediate action be taken, and that in order to obtain an expression from the citizens, a committee of citizens, consisting of Messrs. A. McDonell, A. Folsom, James Shearer, C. M. Averell, D. C. Smalley, George Lewis, A. Van Den Brooks, T. A. E. Weadock, D. J. Kennedy and L. S. Coman, be requested to report to the Council what, in their judgment, would be for the best interests of the city.

The citizens committee submitted their report at the regular meeting of the Common Council held March 15th, as follows:

To the Hon. Mayor and Common Council of Bay City:

Gentlemen—The committee of citizens appointed by your honor-

able body, February 22nd, 1886, to consider the matter of increased water service for fire protection and domestic use, beg leave to submit the following report:

The committee met in the Council Chamber Wednesday, March 10th.

The board of water works and superintendent of water works were present by request of the committee and presented a brief statement of the capacity of the present works, plans of pipeage, and what improvement they considered necessary.

A sub-committee consisting of Messrs. James Shearer, D. C. Smalley and George Lewis was appointed to make a personal examination of the several branches of the works and report at an adjourned meeting of the committee to be held in the Council Chamber Saturday, March 13th, at 4 o'clock p. m.

The committee met pursuant to the above adjournment and the sub-committee presented the following report:

HON. A. MCDONELL, CHAIRMAN OF CITIZEN'S COMMITTEE ON WATER WORKS:

SIR—The undersigned, a sub-committee of the committee of citizens appointed by the Common Council to report a plan to increase the efficiency of the water works of this city, would report to said citizen's committee and recommend as follows, viz:

Your committee visited the water works pumping house and examined the machinery and present plan of pipeage and also the plan proposed by the board of water works to increase the pressure for fire service and domestic supply, and feel compelled to strongly recommend as first in importance, That the power of the pumping machinery be increased by the addition of an engine and pumps of 4,000,000 gallons capacity per twenty-four hours. This will reduce the chances of breakage in the pumping machinery, probably one half, by reducing the speed at which it is now necessary to run the present engines and pumps, and further, in case of accident in an ordinary pipe, the greater capacity for pumping the increased quantity of water would overcome the waste arising from any ordinary breakage of pipes or hydrants.

If nothing more is done, increased capacity should be provided for. The cost would be about $20,000.

As second in importance your committee strongly recommend a separate main line of proper size from the pumping house along Trumbull street to Center avenue, to be connected with Second street header. This will cost about $12,300.

This main line to be entirely independent of the present system of pipeage by valves, etc.

Your committee would also recommend, as in the same degree important, such pipeage on the line of Broadway, and to connect certain

dead ends of pipes in the Fifth, Sixth and Seventh wards, now recommended by the board of water works, as would cost about $5,000.

The foregoing would insure the safety and efficiency of the present pipeage for fire service throughout the city by means of the reinforcement.

To accomplish the purchase and to carry into effect, the first two recommendations, your committee would respectfully suggest that the Common Council can probably purchase an engine and pumps of the capacity proposed on such terms as will be convenient at not to exceed four per cent interest per annum, and if, in addition, they would instruct the board of water works to use the water works fund and the revenue from water service for pipe extension, or, if the Common Council prefer to devote a portion of the license fund for two or three years to this purpose, your committee are of the opinion that no further appropriation will be necessary for several years.

[Signed.] JAMES SHEARER, D. C. SMALLEY, GEORGE LEWIS, } Sub-Committee.

This report was adopted by your committee, and is now presented to your honorable body as the report of the full committee, all of the recommendations embraced in said report having been fully endorsed.

[Signed.] A. McDONELL, Chairman Committee of Citizens.

This report was received and ordered published with the proceedings.

At the next following meeting of the Common Council a special committee, consisting of Aldermen Rose, Miller and Gustin, and the superintendent of water works, was appointed to receive proposals for furnishing the pumping engines as recommended in the report.

The proposals received the preceding year by the board of water works from the Holly Manufacturing Co., E. P. Allis & Co. and the Geo. F. Blake Manufacturing Co., were laid before the committee with a statement of the conclusions of the board with reference thereto.

Mr. Linneen, representing the Holly Manufacturing Co., was present at a meeting of the committee and submitted a supplementary proposition, which gave to the city the option of paying for the pumping engine which they proposed to furnish, either in six equal annual payments, commencing at time of its delivery, or in four equal annual payments commencing three years after its delivery.

This proposition was submitted to the council March 29th, and a resolution was adopted instructing the board of water works to enter into

tract with the Holly Manufacturing Co. in accordance with the pro-
al submitted, to be paid for in accordance with the second option, or
our equal annual payments, the first payment to be due three years
r the delivery of the machinery.

In compliance with this resolution the board entered into a contract
the Holly Manufacturing Co. on the 30th day of March, 1886, for
askill horizontal compound condensing crank and flywheel pump-
engine of 4,000,000 gallons daily capacity, when running at a
on speed of not more than 108 feet per minute, which pumping
ine was to be capable of doing an economical duty of 100,000,000
pounds, on the basis of 10 lbs. of water evaporated in the boilers to
pound of coal consumed, and also to be capable of running at a
ed of 30 revolutions per minute when pumping against 120 lbs.
ssure in the mains, the engine to be delivered, set up and ready to
on the first day of September, 1886.

The contractors were to furnish the steam and water connections
de the building, suction pipe complete, and place the engine in
plete running order on foundations to be built by the city.

The foundation was commenced in May and completed in time to
ome perfectly set before the engine was placed thereon. The first
load of machinery was received September 26th, the balance was
eived within a few days thereafter, when the work of erection was
secuted by the contractors as fast as possible. The engines were
ted on the evening of October 21st, were shut down October 27th
e painted, started again November 6th, since which the city supply
been pumped by these engines, except for a short time they have
n shut down for packing rods and feed pumps.

On the afternoon of December 7th the board met at the pumping
tion for the purpose of examining the engines and making such tests
were practicable, for the purpose of determining, as far as possible,
ether the engine had been completed in conformity with the terms of
contract.

Very complete tests were made as to the capacity of the engines,
egarded the quantity of water they were capable of pumping, the
ter being wasted through a blow-off valve near the engine house.

They were run, at one time, up to a speed of 40 revolutions per
nute, which represents a capacity of nearly 7,000,000 gallons for 24
rs, but this was evidently beyond the safe capacity. At 32 revolu-

tions per minute, representing a capacity of a little more than 5,500,000 gallons per day of 24 hours, the engines worked smoothly and satisfactorily, and the water pressure was easily carried at 90 lbs. per square inch when running at this speed. By admitting live steam to the low pressure cylinders the water pressure was readily increased to 120 lbs. per square inch, and the engine run at 30 revolutions per minute when pumping against this pressure without any undue strain being apparent.

The tests were in all respects satisfactory.

The question of making a duty test was left to be decided at a future meeting of the board, the expense involved in preparing for such a test being considerable, as it would be necessary to weigh the feed water to the boilers, and from the saving in fuel already apparent there appeared to be no doubt of the ability of the engines to perform the guaranteed duty.

At a meeting of the board, held December 16th, it was decided, under advice from the city attorney, to issue the certificates of indebtedness to the Holly Manufacturing Co. in accordance with the terms of their contract, said certificates to be issued in the form of time orders on the treasurer of the board, payable in three, four, five and six years from November 1st, 1886, with interest at four per cent per annum, payable annually from the before mentioned date, and the president and secretary were instructed to issue said orders.

The advice of the city attorney was that the contractors were entitled to their certificates, that it was proper for the board to issue them in this manner, and that the rights of the city to compel a fulfillment of the contract, as regarded duty, would not be at all prejudiced by the delivery of the orders.

The orders were issued to the Holly Manufacturing Co. on the 20th day of December, and were in the form of four special orders on the treasurer of the board for the sum of $4,500 each, payable on the dates, and with interest as above noted, at the Merchants National Bank of Albany, New York.

The new pumping engines are now working satisfactorily, no difficulty is experienced in increasing the fire pressure to any required point within the limit of what is considered safe for the pipe lines, and the saving in fuel is considerably more than sufficient to pay the interest on their cost. The saving for the month of December was about 75 cords

d the water pressure was maintained fully five pounds higher than
ıen running the old engines.

The pumping plant now consists of one Gaskill horizontal com-
und condensing crank and flywheel pumping engine of easy 5,000,000
llons daily capacity; one Holly quadruplex compound condensing crank
d flywheel pumping engine of 3,000,000 gallons daily capacity; one
rizontal high pressure piston engine driving two No. 10 Holly rotary
mps of about 2,500,000 gallons daily capacity; three horizontal tubu-
boilers, set in separate brick arches, length 16 feet, diameter of shell
inches, number of flues 105, $2\frac{3}{4}$ inches in diameter; grate surface
der No. 1 boiler, $27\frac{1}{2}$ square feet; under Nos. 2 and 3, each 34 square
et; heating surface, each boiler, ($\frac{1}{2}$ shell 138.24, tubes 1209.51;)
47.75 square feet.

The boilers are in fair condition except No. 1, which has two
tches on the shell immediately over the fire, which it appears to be
possible to keep from leaking. The tubes in this boiler have also
en a constant source of annoyance and expense during the past year
ım leakage where they are joined to the heads.

Until the new pumping engines were in operation it was not safe
discontinue the use of this boiler a sufficient length of time to make
e necessary repairs. These repairs are now being made, a new fire
eet being placed in the shell and the tubes taken out and welded, the
ell and tubes being thoroughly cleaned. These repairs will make this
iler nearly as good as new.

The fuel used is pine slabs and edgings, costing $1 per cord, de-
ered in front of the boilers in the fireroom.

The total quantity of water pumped was 779,761,852 gallons,
hich is about 57,000,000 gallons less than was pumped in 1885. Aver-
ge per day, 2,136,334 gallons. The greatest quantity pumped in one
y was August 10th, 2,898,979 gallons; least quantity pumped in one
y, Sunday, April 25th, 1,691,250 gallons.

Of the total quantity of water pumped 768,485,051 gallons were
mped against an average domestic pressure of 40 lbs. per square inch
the level of the pressure gauge in the engine house, which is equiva-
nt to a lift of 107 feet from the surface of the water in the suction well,
d 11,276,801 gallons were pumped against an average fire pressure of
lbs. per square inch at the gauge, equivalent to a lift of 212 feet

from the surface of the water in the well, the average level of the water being lowered nearly three feet when running for fire service.

The average lift for all the water pumped was 108½ feet.

The number of cords of slabs burned during the year was 3,324½, which was 241½ cords less than was burned in 1885. This is partially due to the less quantity of water pumped, and partially to the saving in fuel from greater economy in running the Gaskill engine over the old engines, nearly 150 cords of fuel having been saved during the months of November and December from this last cause.

The total cost of running the pumping engines for the year was:

For fuel consumed	$3,324 75
For oil, packing, etc., used	465 40
For repairs to pumping machinery	166 34
For engineers' and firemen's wages	3,480 00
Total	$7,436 49
Cost per million gallons pumped	$9 54
Cost per million gallons raised 100 feet	8 79
Cost of fuel, per million gallons pumped	4 26
Cost of fuel, per million gallons raised 100 feet	3 93

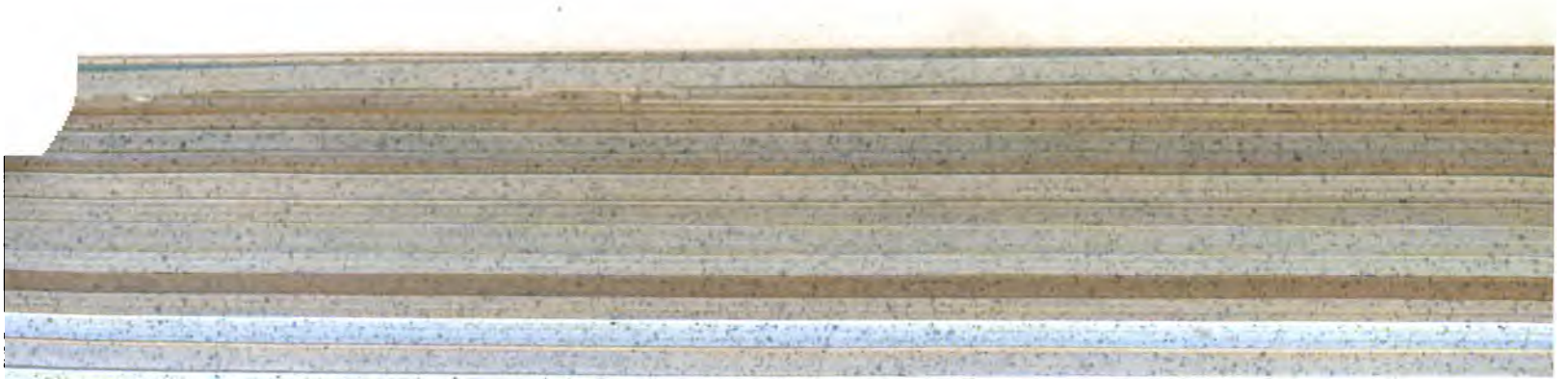
The total quantity of water pumped each year since the works commenced operations has been as follows:

	Gallons.		Gallons.
1873	142,477,725	1880	827,067,572
1874	294,714,798	1881	944,282,043
1875	416,756,579	1882	775,642,466
1876	518,197,129	1883	773,942,702
1877	538,847,186	1884	831,867,463
1878	530,197,397	1885	896,970,088
1879	672,344,128	1886	779,761,852

Water Pumped.

MONTH.	GASKILL ENGINES & PUMPS.			QUADRUPLEX.			ROTARY PUMPS.			TOTALS.		FIRE RECORD.					
	Hours Run.	Revolutions.	Gallons Pumped.	Hours Run.	Revolutions.	Gallons Pumped.	Hours Run.	Revolutions.	Gallons Pumped.	Gallons Pumped.	Daily Average.	No. Alarms.	Hrs Run.	Highest Pressure.	Lowest Pressure.	Average Pressure.	Gallons Pumped.
January				743.09	1,196,098	65,780,390	6.28	35,044	595,748	66,326,138	2 139,553	13	12.01	120	65	84	2,071,417
February				670.12	1,095,698	60,263,390	5.11	26,372	448,324	60,711,714	2,168,275	13	8.40	90	75	80	1,396,759
March				742.34	1,215,870	66,872,850	1.26	8,956	152,252	67,025,102	2,162,100	7	3.17	80	75	79	419,155
April				720.00	1,073,280	59,030,400				59,030,400	1,967,680	6	3.21	80	80	80	411,400
May				739.46	* 1,098,417	59,788,076	8.33	44,424	755,208	60,543,284	1,953,009	13	12.16	100	80	90	1,887,533
June				716.25	† 1,172,359	64,460,622	3.35	24,648	419,016	64,879,638	2,162,654	5	1.51	80	80	80	251,295
July				739.14	‡ 1,397,508	76,096,860	5.14	32,185	547,145	76,644,005	2,472,387	16	4.40	80	70	80	727,756
August				741.05	1,326,146	72,938,030	4.05	23,682	402,594	73,340,624	2,365,826	6	3.16	80	70	77	570,584
September				717.10	1,184,810	65,164,550	4.30	26,784	455,328	65,619,878	2,187,329	8	2.13	80	60	73	448,008
October	105.37	70,377	8,515,617	637.23	992,520	54,588,600	1.14	7,597	129,149	63,233,366	2,039,875	9	2.28	80	60	70	329,777
November	558.35	381,808	46,198,768	161.25	256,274	14,095,070				60,293,838	2,009,794	9	15.23	100	70	84	2,242,229
December	733.20	504,575	61,053,575	10.40	19,278	1,060,290				62,113,865	2,003,673	8	3.30	80	70	79	444,554
Totals	1397 32	956,760	115,767,960	7339.03	12,027,258	660,089,128	40.16	229,692	3,904,764	779,761,852	2,136,334	113	72.56	120	65	84	11,200,412
September—Testing mains													25	140	100	116	76,389
Total													73.21	140	65	84	11,276,801

* May—23,856 revolutions; three pumps; at 41 gallons per revolution.
May—22,375 revolutions; three pumps; at 42 gallons per revolution.
† June—1,471 revolutions; three pumps; at 42 gallons per revolution.
‡ July—54,716 revolutions; three pumps; at 41 gallons per revolution.



Main Distribution.

Main pipe laid during the year:

	20-in.	16-in.	12-in.	10-in.	8-in.	6-in.	4-in.	Total.
Cast iron	44	57	4,200	55	2¼	12½	107⅜	4,678
Wyckoff patent				4,066	1,478	2,634¾	856⅝	9,035
Total	44	57	4,200	4,121	1,480½	2,647¼	964	13,713

Pipe taken out:

	10-in.	6-in.	4-in.	Total.
Cast iron	2½	3		5
Wyckoff patent	16¾	355¼	44	416
Total	18¾	358¼	44	421

Valves set during the year:

	16-in.	12-in.	10-in.	8-in.	6-in.	4-in.	Total.
Galvin's patent	1	2	4	1	3	25	36

One 4-inch valve was taken out but was again set in nearly the same location.

Fire hydrants put in during the year:

Galvin's patent	5
Gaskill patent	15
Total	20

All of these hydrants are double discharge post hydrants with 4-inch inlet.

The length of pipe laid and cost of each line is as follows: Connecting discharge of new Gaskill pumps with old 16-inch main; 44 feet of 20-inch cast iron pipe and specials; 57 feet of 16-inch cast iron pipe and specials; one 16-inch valve.

The cost, including cost of cutting the old 16-inch main and putting in branch, was $668.75. This includes the original cost of 12 feet of 16-inch pipe and 12 feet of 20-inch pipe left in stock.

Pipe in Trumbull street, from Water street to Second street:

3,105 feet of 12-inch cast iron pipe and specials.
91½ " 4-inch " " " to hydrants.
One 12-inch valve and seven 4-inch valves.
Four fire hydrants.

The cost, including cost of cutting old 12-inch main in Water street and putting in branch, was $5,377.16.

Pipe in Trumbull street, from Second street to Center avenue.

1,477 feet of 10-inch Wyckoff pipe.
14½ " 10-inch cast iron branches.
32 " 4-inch Wyckoff pipe to hydrants.
One 10-inch and three 4-inch valves.
Three fire hydrants.

The cost, including cost of cutting 6-inch main in Center avenue making connections therewith, was $1,751.82.

Pipe in Second street, from Trumbull street to Johnston street:

1,095 feet of 12-inch cast iron pipes and specials.
8 " 4-inch cast iron pipe for hydrants.
One 12-inch valve and two 4-inch valves.

The cost, including cost of cutting 10-inch main on Johnson street making connections therewith, was $1,892.99.

Pipe in Second street, from Johnson street to alley between Jack- and Van Buren streets:

2,581 feet of 10-inch Wyckoff pipe.
35 " 10-inch cast iron branches and specials.
65 " 4-inch Wyckoff pipe to hydrants.
Two 10-inch, one 6-inch, and seven 4-inch valves.
Seven fire hydrants. (Three hydrants not paid for.)

The cost, including cost of cutting 6-inch main on Grant street and king connection therewith, including cost of a 6-inch valve placed in nt street main, was $3,165.39.

Placing 10-inch valve in Johnson street main, near south line Sec- street, one 10-inch valve and Wyckoff pipe and sleeve for connect- up the same cost $42.77.

Placing 6-inch valve in old main on north side Center avenue, near west line of Sherman street, one 6-inch valve and pipe and sleeve connecting up the same cost $22.63.

Pipe in Center avenue, north of pavement, from Johnson street to eridan street:

1,478 feet of 8-inch Wyckoff pipe.
2½ " 8-inch cast iron branches.
One 8-inch and one 4-inch valve.
One fire hydrant.

The cost, including cost of changing branch in Johnson street main, m 6-inch to 8-inch, $1,276.21.

Pipe in Center avenue, north of pavement, from alley between fferson and Madison streets to alley between Adams and Jefferson eets:

265½ feet of 6-inch Wyckoff pipe.
1½ " cast iron branches.

Cost $100.32. (224 feet of this pipe was old pipe, and the state- nt of cost includes cost of taking up, testing and recoating.)

Pipe in Fourth street for fire hydrant at the corner of Fourth and ashington streets:

131 feet of 4-inch Wyckoff pipe.
One 4-inch valve.
One fire hydrant.

The cost, including cost of cutting 4-inch main in alley between Saginaw and Washington streets and putting in branch, $100.75. (27 feet of this pipe is old pipe taken out, and this cost includes cost of testing and recoating this pipe.)

Pipe on west side Water street south of Sixth street:

108 feet of 6-inch Wyckoff pipe taken out, tested and recoated.

Cost, including cost of taking out, testing and recoating, $28.80.

Pipe on Sixth street, Adams street, and Seventh street, around the east half of block 34:

115 feet of 4-inch Wyckoff pipe in Sixth street.
330 " " " " Adams street.
125 " " " " Seventh street.
3 " 6-inch cast iron branches in line of alley between Washington and Adams streets, and 2 feet of 4-inch cast iron elbows in Adams street. Cost $98.0[illegible]

Pipe in Fitzhugh street, from Fifteenth street to Twenty-second street:

2,241 feet of 6-inch Wyckoff pipe.
5 " 6-inch cast iron branches.
23 " 4-inch Wyckoff pipe to hydrants.
One 6-inch valve and three 4-inch valves.
Three fire hydrants. Cost $1,443.28.

Pipe in Twelfth street, leading to fire hydrant on the corner of Twelfth and Fitxhugh streets:

15 feet of 4-inch Wyckoff pipe to hydrant.
One 4-inch valve.
One fire hydrant.

Cost, including cost of cutting 4-inch main in Fitzhugh street and putting in branch, $47.76.

One 4-inch valve and three cast iron valve boxes have been purchased during the year which have not been used. Cost $20.00.

Total amount paid for extension of main pipes, valves and hydrants, $16,181.16.

Total length of distributing mains connected with the works:

	20-in.	16-in.	12-in.	10-in.	8-in.	6 in.	4-in.	3-in.	Total
Cast iron	44	1,467	9,083	8,527¾	1,940¾	998¾	784¼		[illegible]
Wyckoff				14,650½	14,695½	57,855¾	20,079¾	319	[illegible]
Total	44	1,467	9,083	23,178¼	16,636¼	58,854½	20,864	319	[illegible]

	Miles.	Feet.
Total cast iron pipe	4	1,725½
Total Wyckoff pipe	20	2,000½
Total distributing mains	24	3,726

	Miles.	Feet.
30-inch stave pipe in inlet from bay	4	66
18-inch stave pipe in inlet from river		386
Total stave pipe	4	452

Number of valves in use:

	16-in.	12-in.	10-in.	8-in.	6-in.	4-in.	3-in.	Total.
...er's patent	1	3	11	28	78	175	3	299
...in's patent	1	2	4	1	3	36		47
...vn's patent		1			1			2
Total	2	6	15	29	82	211	3	348

One 30-inch in inlet pipe from bay.
One 18-inch in inlet pipe from river.

Number of public fire hydrants:

Holly's patent	118
Gaskill's patent	15
Matthew's patent	41
Galvin's patent	5
Brown's patent	1
Total	180

No material addition can be made during the present year to the ...e system unless an appropriation is made to defray the expense, and ...ecommend that whatever money is expended on this branch of the ...rks be in the way of increasing the supply to that part of the city ...ng south of Tenth street.

A line of pipe should certainly be laid in the alley between Adams ... Jefferson streets, south of Tenth street as soon as possible.

The Common Council has passed a resolution instructing the board ...place three fire hydrants along the west side of Water street, between ...ond and Sixth streets.

This will be an expensive work, owing to the location and sur...ndings of the main pipe, and cannot well be done at this season of ... year, but it is much needed and should be completed as soon as ...sible in the spring.

The hydrants will need to be of special length and will have to be ...de to order.

The number of leaks discovered in the main distributing pipes was ... or about 1¼ per mile. Two of these leaks were in cast iron mains. ...e of these was caused by the lead blowing out of a joint, and one by ...and hole which was easily repaired with a half-inch gas plug.

Twenty-eight were in Wyckoff patent pipe, of which eleven were ...ks in joints, six were small knot holes, six were caused by broken

bands, three were from shaky timber, and two were caused by the blowing out of plugs not securely braced.

In repairing these leaks it was necessary, in eight cases, to insert new sections of pipe. The other leaks were repaired by caulking with pine wedges, and replacing the plugs where they were started.

The cost of these repairs to Wyckoff mains, including all labor and material, was $140.40, or less than $7.00 per mile for all of this kind of pipe in use.

A large number of these leaks developed soon after Trumbull street main was completed, and was the immediate result of the increased pressure on the entire pipe system, caused by connecting up that pipe.

Meters and Services.

The number of meters put in during the year was 39, of the following size and kinds:

	2-in.	1-in.	¾-in.	½-in.	⅝-in.	Total
Union Rotary	1					1
Crown		2		1	1	4
Empire			13	20		33
Worthington	1					1
Totals	2	2	13	21	1	39

Meters taken out:

	2-in.	1½-in.	1-in.	¾-in.	⅝-in.	Total
Union Rotary	1	1				2
Crown			5	3	1	9
Empire			2	3	3	8
Totals	1	1	7	6	4	19

Meters now in use;

	8-in.	4-in.	3-in.	2-in.	1½-in	1-in.	¾-in.	⅝-in.	½-in.	⅜-in.	Total
Union Rotary	1	5	18	5	2	2	1	3			37
Union Duplex								2			2
Crown					1	21	31		28	1	82
Empire						4	20		21		45
Worthington				2	6						8
Total	1	5	18	7	9	27	52	5	49	1	174

Of the one hundred and seventy-four meters now in use, one hundred and sixty are in separate services and meter rates are charged for the water supplied through them, the other fourteen are on sub-mains supplying a number of consumers, having been set for the purpose of testing the quantity of water used from the pipe, and to aid in loc

smaller meters on individual services where they will do the most
d.

Of the meters taken out, two were replaced by larger meters, one
smaller meter, two by meters of the same size, and fourteen were
replaced, nine of them being test meters permanently removed and
were taken out by reason of the use of water having been perman-
y abandoned for the purpose on account of which the meters were
ed.

No necessity now exists for any large expenditure on this branch
he works, but I recommend that all new services, where water fix-
s are so located that considerable quantities of water can be wasted,
netered as soon as put in, and that the system be gradually extended
hose premises where water is now in use when consumers request
they be put on, or when the water is found running to waste un-
essarily.

Six meters have been found broken; one was broken by frost, one
ed by having hot water forced back through it from a steam boiler,
were broken by small pieces of wood lodging in them while they
e in motion, and two were broken by unauthorized persons taking
n apart, and attempting to put them together again without getting
parts in proper position.

Ninety-four meters have been taken apart and thoroughly cleaned,
ty-nine of them had stopped registering, the working parts having
ome clogged with rust or pieces of wood.

All of the meters, except the test meters, are read each month, and
hey do not appear to be working properly are carefully examined
repaired if necessary.

The number of new service connections made with the main pipes
44.

	4-in B	1-in.	¾-in.	⅝-in.	½-in.	Total.
Iron mains			1	1	3	5
koff mains	1	3	10	15	10	39
Total	1	3	11	16	13	44

Number of service connections taken out:

	1-in.	¾-in.	½-in.	Total.
koff mains	1	2	3	6
Total	1	2	3	6

Whole number of service connections made with main pipes 1,3[illegible] as follows:

	8-in B	6-in B	4-in B	3-in B	2-in B	2-in	1¼-in	1-in	¾-in	⅝-in	½-in	⅜-in	Tota
Cast iron mains.....		2	9			2	6	43	55	32	81	5	[illegible]
Wyckoff mains.....	1	2	10	1	1	13		129	388	164	388		1,09[illegible]
Total.....	1	4	19	1	1	15	6	172	443	196	469	5	1,32[illegible]

Twenty-six branch services and one thousand three hundred and six connections made with corporation cocks.

Six service connections have been abandoned and shut off at the main pipe, making whole number shut off at the main fifty-six, which includes one 4-inch branch with which no service has ever been connected.

This leaves the number of service connections now in use 1,27[illegible] through which are supplied 1,369 separate and distinct service pipes, of which 1,100 are open and 269 are closed at the stop-cock at the curb or the lot line. Seven service pipes have been found leaking between the tap and the shut-off cock, where the leakage was evidently the result of injury from settlement of sewer excavations, or other similar cause aside from ordinary wear and tear, and were repaired without expense to the consumer.

Two hundred and sixty-seven service pipes have been shut off by employes of the board, of which 71 were shut off for non-payment of rates, 29 for leakage, 68 by request of consumers, and 99 premises found unoccupied.

The number of service pipes turned on by employes of the board was 283.

Receipts and Expenditures.

The amount of cash collections made during the year has been as follows:

From water rates, roll of 1880	$ 3 75	
" " " " 1882	8 00	
" " " " 1883	10 00	
" " " " 1884	1 05	
" " " " 1885	149 54	
" " " " 1886	19,214 63	
Total from water rates		$19,386 97
" plumbers' licenses		35 00
" rent of dock and boom		125 00
" sale of service taps		166 50
Total receipts		$19,713 47

This amount has been deposited with the city treasurer to be placed he credit of the water works fund as follows:

January 30th	$1,940 54
February 27th	923 18
March 31st	1,696 63
April 30th	2,269 37
May 31st	1,061 16
June 30th	1,154 39
July 31st	2,944 34
August 31st	1,123 67
September 30th	1,133 89
October 30th	2,098 24
November 30th	1,478 70
December 31st	2,489 36
Total	$19,713 47

The expenditures for the year have been for the following general ounts:

For office expenses and salary account	$ 2,849 58	
repairs and care of hydrants, valves and pipes	607 07	
repairs and care of water meters	237 29	
care of reservoirs and inlet works	279 25	
repairs to breakwaters	2,462 36	
repairs to engine house	515 01	
repairs to foundations	13 50	
implements and tools	178 75	
Total paid maintenance except pumping		$7,142 81
For engineers' and firemen's wages	3,480 00	
fuel account	3,315 00	
oil, packing and engineer's supplies	424 46	
repairs to pumping machinery	166 34	
Total paid pumping expenses		$ 7,385 80
Total paid maintenance accounts		$14,528 61
For breakwater at bay (stone filling)	640 50	
buildings at bay shore	78 33	
engine foundations	1,004 52	
pumping machinery	201 98	
iron pipe and branch casting	6,477 57	
Wyckoff pipe	6,179 72	
valves	658 89	
fire hydrants	453 85	
laying iron pipe	1,380 17	
laying Wyckoff pipe	1,030 96	
water meter account	629 72	
Total paid construction accounts		$18,736 21
For service tap accounts		80 86
Total		$33,345 68

In addition to the above amount, time orders have been issued to Holly manufacturing company for the sum of $18,000, and payable follows:

November 1st, 1889	$ 4,500 00	
November 1st, 1890	4,500 00	
November 1st, 1891	4,500 00	
November 1st, 1892	4,500 00	
		$18,000 00
Total amount charged construction account		35,736 21
Total amount charged for all accounts		$53,345 09

Of which amount $18,000 as above is credited to bills payable. The details of expenditures have been as follows:

For office expenses and salary account:

Superintendent and secretary's salary	$ 1,800 00	
Treasurer's salary	100 00	
Assistant in office	600 00	
Postal cards and postage stamps	59 50	
Blank receipts, notices, etc	27 00	
Assessment roll and record blanks	44 00	
Publishing advertisements for proposals	4 10	
Publishing report of superintendent for 1885	56 00	
Extra copies of Dr. Prescott's report	4 50	
Binding three volumes of foreign reports	3 00	
Accountant examining books of 1885	30 00	
Stationery, ink, pens, pencils, etc	14 92	
Coal and cleaning office	14 30	
Rent of telephones (2)	80 00	
Exchange on drafts and telegrams	12 26	
		$ 2,849 28

For repairs and care of hydrants, valves and pipes:

Labor repairing two leaks in iron pipes	$ 1 87	
Material for same	2 50	
Labor repairing 28 leaks in Wyckoff pipes	97 32	
Material for same	43 08	
Labor and material repairing 7 service pipes	22 50	
Labor examining, turning on and shutting off service pipes	271 44	
Labor examining and repairing hydrants and valves	127 25	
Shop work and material for repairing hydrants and valves	26 01	
Labor repairing service taps and shutting off abandoned taps	9 38	
Labor cleaning wells	5 63	
		607 07

For repairs and care of water meters:

Labor reading, examining and cleaning meters	$ 173 06	
Packing to protect from frost	6 50	
Repairs to meters broken by frost	5 90	
Repairs to meters injured by hot water	8 10	
Repairs to 4 meters injured in use	7 10	
New dials	3 40	
Draining and repairing meter boxes	9 12	
Moving and re-setting meters when location was changed	7 77	
Taking out 16 meters	16 34	
		237 29

For care of reservoir and inlet works at bay:

Labor removing grass, driftwood and debris from banks of reservoir and inlet cut, and keeping the banks clean	279 25

r repairs to breakwaters:

White oak piles, 723	$ 740 50	
Pulling old piles, 119	66 25	
Driving 862 piles at $1.15 each	991 30	
White oak plank, 9,263 feet	137 86	
Freighting plank to bay	9 45	
Boat spike, 1,250 lbs	46 13	
Labor	470 87	
		2,462 36

r repairs to engine house:

Repairing old floor around foundations	$ 9 72	
Repairing slate roof	10 44	
Repairing windows	4 67	
Repairing and extending sewer	2 00	
Ceiling under roof of engine room	147 05	
Plastering walls of engine room	50 00	
Picture strips and hooks	2 00	
Windows in foundation and new bond timbers	68 54	
New floor, steps, wardrobe, etc	196 97	
Labor cleaning up house and grounds	23 62	
		515 01

r repairs to engine foundations:

Cast iron girder under H. P. engine	$ 6 06	
Mason work putting in girder	7 44	
		13 50

r implements and tools:

Derrick, chainhoist, lead furnace and ladles, caulking irons, chisels, bars, pipe-jointer and clamps, hand-axe and tool box for pipe laying and street work	$ 89 72	
Repairing chisels, bars and pipe laying tools	3 25	
Files, bits, shovels, sledges, wheelbarrows, axe, etc., for workmen at bay inlet	17 40	
Handles and repairs of tools at bay	2 60	
Repairing and caulking lighter at bay	14 63	
Files, wrenches, saws, hammer, lanterns and tools for street work repairs	8 25	
Repairing tools used on street work	2 81	
Files, hammers, wrenches, step ladder, flue scraper and tools for engineers	19 49	
Repairing chain hoist, pipe cutters, wrenches and tools for engineers	20 60	
		178 75

r engineers' and firemen's wages:

First engineer's salary, one year	$ 1,200 00	
Second engineer's salary, one year	960 00	
Two firemen one year, $660	1,320 00	
		3,480 00

r fuel for running pumping engines:

Slabs and edgings, 3,315 cords at 70 cts per cord	$ 2,320 50	
Delivering 3,315 cords in fire room at 30 cts. per cord	994 50	
		3,315 00

For oil, packing and engineer's supplies:

Cylinder oil	$ 78 16	
Lard oil and lubricant	9 51	
Hemp and cotton packing	13 20	
Eureka, ring and heston packing	28 23	
Square rubber packing	11 61	
Sheet rubber packing	7 52	
Leather and rivets for pump valves	22 60	
Red lead, oil and plumbago	2 41	
Wipers and cleaning material	47 25	
Brooms and steam hose	27 71	
Oilers, hand lamps, etc	1 60	
Kerosene oil, wicks and chimnies	62 00	
Boiler compounds	91 16	
Soap, ice, etc	21 50	
		424 46

Repairs to pumping machinery:

Repairing feed pumps on old engine	$ 22 25	
Repairing old pony pump	1 35	
Gas pipe, valves and fittings	12 02	
Sheet copper, brass, tin and solder	2 18	
Caps and clamps for old exhaust and steam pipes	6 85	
Paints, oils and leather belting	4 93	
Repairs to boilers	63 52	
New fire sheet for No. 1 boiler	38 24	
Boiler inspection	15 00	
		166 34

For breakwaters at bay:

Stone for filling breakwater, 108 cords		640 50

For buildings at bay shore:

Material for addition to dwelling	$ 61 10	
Plastering addition	17 23	
		78 33

For engine foundations:

Excavating for fonndations of new engines	$ 51 50	
Tearing out old walls	9 93	
Stone for foundation, 31 cords	217 00	
Hauling 23½ cords of stone from dock	18 25	
Sand for foundation, 19 loads	22 15	
Mason's work, paid by the day	316 69	
Cement, 65 bbls	71 50	
Draining foundation	7 89	
Coping stone	275 00	
Dressing off coping and lead for levelling	13 60	
Bolts, wire, etc	1 01	
		1,004 52

For pumping machinery:

Freight, express charges and telegrams	$ 9 51	
Expenses of superintendent to Lockport on new engines	29 00	
New valves for steam pipe, old engines	95 00	
Covering steam pipe, old engines	23 86	
Bolts and pipe for moving throttles, old engine	15 47	
Pipe and valves for resetting old pony	17 11	

Sewer for overflow, new engine	1 92	
Oil drips and plate for step, new engine	10 11	
		201 98

iron pipe and branch castings:

8 405-2000 tons of 16-inch and 20-inch pipe at $30	$ 246 08	
6,489 lbs. of 16-inch and 20-inch specials at 3¼ cts	210 89	
Freight on 16-inch and 20-inch pipe from Louisville	40 98	
188 1612-2000 tons of 12-inch pipe at $27.55	5,201 58	
17,805 lbs. of 12-inch specials at 2½ cts	445 12	
1 129-2000 tons of 4-inch pipe at $27,55	29 33	
Expenses of superintendent to Cleveland on pipe contract	19 25	
Cast iron branches and specials laid in Wyckoff pipe lines, 30 pieces	284 34	
		6,477 57

Wyckoff patent pipe:

4-inch pipe in Sixth, Adams and Seventh streets, 570 feet	$ 169 05	
Testing and recoating old 6-inch laid in Water street, 108 feet	8 10	
Testing and recoating old 6-inch laid in Center avenue, 224 feet	16 79	
New 6-inch pipe and sleeve in Center avenue, 42 feet	21 59	
6-inch pipe and sleeve for setting valve, Center avenue and Sherman street	5 44	
Testing and recoating old 4-inch pipe in Fourth street, 27 feet	2 04	
New 4-inch pipe in Fourth street, 103½ feet	30 45	
4-inch pipe and sleeve for connecting branch in alley between Saginaw and Washington streets at Fourth street	3 34	
8-inch pipe and sleeve in Center avenue, 1,478 feet	997 23	
Pieces for changing branch corner of Center and Johnson streets	1 65	
6-inch pipe and sleeve in Fitzhugh street, 2,241 feet	1,069 64	
4-inch pipe for hydrants in Fitzhugh street, 23 feet	6 71	
10-inch pipe in Trumbull street, 1,461¼ feet	1,370 99	
Testing and recoating old 10-inch pipe laid in Trumbull street, 15 feet	1 50	
4-inch pipe to hydrants in Trumbull street, 21½ feet	6 34	
6-inch pipe and sleeve for connecting branch corner Center and Trumbull streets	5 38	
10-inch pipe and sleeves in Second street, 2,582 feet	2,428 98	
4-inch pipe to hydrants in Second street, 58¼ feet	17 14	
6-inch pipe and sleeve for branch in Grant and Second street	4 09	
10-inch pipe and sleeve for branch, Johnson and Second streets	9 52	
4-inch pipe and sleeve for hydrant, corner of Twelfth and Fitzhugh streets	3 75	
		6,179 72

r valves for street mains:

One 4-inch, one 6-inch and one 8-inch in Center avenue	$ 47 00	
One 4-inch in Fourth street	9 00	
One 12-inch and two 4-inch in Second street iron pipe	61 00	
One 12-inch and seven 4-inch in Trumbull street iron pipe	106 00	
One 6-inch and three 4-inch in Fitzhugh street	41 00	
One 10-inch and three 4-inch in Trumbull street, Wyckoff	59 50	
Two 10-inch and seven 4-inch in Second street, Wyckoff	128 00	
One 10-inch in Johnson street	32 50	
One 6-inch in Grant street at Second street	14 00	
One 4-inch in Twelfth street at Fitzhugh street	9 00	
One 16-inch in front of engine house	80 00	

One 4-inch in stock	9 00	
One dozen iron valve boxes	44 10	
Wood valve boxes	2 10	
Iron covers for wood valve boxes, 22	14 44	
Cartage on valves	2 25	
		658 89

For public fire hydrants:

One Galvin hydrant set in Fourth street	$ 26 50	
Four " " " Trumbull street	106 00	
One Gaskill " " Center avenue	26 50	
Three " " " Fitzhugh street	79 50	
Three " " " Trumbull street	79 50	
*Four " " " Second street	106 00	
One " " " Fitzhugh street	26 50	
Bolts, cartage and sewerage to hydrants	3 35	
		453 85

* Three more Gaskill hydrants set in Second street not yet paid for.

For laying iron pipe:

Cutting 12-inch main on Water street at Trumbull street	$ 15 75	
Laying 3,112 feet of 12-inch and 91½ feet of 4-inch pipe in Trumbull street	533 15	
Cartage on pipe to Trumbull street	63 05	
Lead and yarn used in Trumbull street	316 64	
Clamps for broken hub	2 00	
Fuel, repairing tools, etc	4 50	
Laying 1,098 feet of 12-inch and 8 feet of 4-inch pipe in Second street	212 57	
Cartage on pipe to Second street	21 00	
Lead and yarn used in Second street	113 90	
Cutting 10-inch main in Johnson street	5 31	
Fuel, repairing tools, etc	1 50	
Cutting 16-inch main in front of engine house	17 50	
Lead, yarn and fuel	4 08	
Laying 57 feet of 16-inch pipe	33 00	
Cartage on same	2 30	
Laying 44 feet of 20-inch pipe	31 62	
Cartage on same	2 30	
		1,380 17

For laying Wyckoff pipe:

Labor taking out 6-inch pipe in block 74	$ 29 57	
" laying pipe in Sixth, Adams and Seventh streets	54 15	
" laying pipe in Water street	10 26	
" laying 6-inch pipe in Center avenue	32 19	
" laying 8-inch pipe in Center avenue	177 98	
" setting 6-inch valve, Center and Sherman streets	2 44	
" laying 4-inch pipe in Fourth street	22 53	
" laying pipe in Fitzhugh street	218 06	
" laying pipe in Trumbull street	162 28	
" laying pipe in Second street	263 00	
" setting hydrant at Twelfth and Fitzhugh streets	5 50	
Cartage, inspection, etc	53 05	
		1,030 96

water meter account:

Fifteen ¾-inch Empire meters at $20.12	$ 301 80	
Fifteen ½-inch Empire meters at $13.50	202 50	
Freight and cartage	2 55	
Two dozen ¾-inch solder nipples	2 70	
One half dozen 1-inch solder nipples	90	
2,120 feet of lumber for meter boxes	21 20	
Cartage on lumber and boxes	2 25	
200 lbs. spike	4 95	
Plumbers work setting meters	43 21	
Common labor, setting and boxing meters	47 66	
		629 72

service tap account:

Two dozen ¾-inch corporation cocks	$ 16 32	
One dozen 1-inch corporation cocks	12 00	
Freight on same	35	
Material for opera house fire pipe	18 94	
Labor putting in same	5 50	
Labor inserting 42 service taps	27 75	
		80 86

The expenditures of the board exceed the receipts $13,632.20, not uding the $18,000 in time orders issued to the Holly Manufacturing These orders draw interest at 4 per cent. per annum, payable ually, both principal and interest being payable at the Merchants ional Bank of Albany, New York.

Water Rates for 1887.

The assessment rates for 1887 amount to $12,688, an apparent in- ase of $31 over the rates assessed on the first day of January, 1886, premises which were charged assessment rates amounting to $157 the first day of January, 1886, are now supplied through meters. teen of the new services put in during 1886, are supplied through ters.

Assessment rates for 1887 are for the following described uses:

1 Armory.
4 Bakeries.
3 Banks.
7 Barber shops.
3 Bath rooms (public.)
1 Bath room (Turkish.)
172 Baths (private.)
2 Billiard rooms.
6 Blacksmith shops.
11 Boarding houses.
6 Bottling works.
1 Business college.
255 Hose for sprinkling.
5 Laundries.
1 Machine shop.
26 Offices.
2 Paint shops.
1 Passenger depot.
5 Photograph galleries.
4 Planing mills.
1 Plumbers shop.
1 Post office.
1 Potash factory.
2 Refrigerators.

21 Business blocks (not classified.)
11 Butcher shops.
2 Carriage shops.
6 Churches.
2 Cigar factories.
1 Clothes cleaning.
1 Cooper shop.
1 Cracker factory.
2 Creameries.
644 Dwellings.
1 Express office.
1 Electric light works.
76 Families in blocks.
1 Flouring mill.
1 Gas works.
3 Gas engines.
1 Green house.
1 Gun shop.
7 Halls (public.)
2 Harness shops.
34 Hotels.
7 Restaurants.
2 Rinks (roller.)
58 Saloons.
1 Salt crusher.
6 Schools.
1 Slaughter house.
1 Soap factory.
8 Stables (livery.)
9 Stables (mill.)
152 Stables (private.)
1 Stone yard.
85 Stores.
4 Tailor shops.
1 Telegraph office.
1 Telephone exchange.
2 Toboggan slides.
2 Undertaker shops.
551 Water closets.
48 Water closets in schools.
2 Water motors.
1 Wood yard.

The following described uses are supplied through meters:

27 Baths (private.)
2 Bakeries.
1 Boarding house.
1 Boiler shop.
1 Bottling works.
8 Business blocks.
1 Carriage factory.
1 Coal and wood yard.
1 Cooper shop.
1 County court house.
1 County jail.
1 Creamery.
14 Drill houses.
106 Dwellings.
1 Electric light works.
1 Gas engine.
1 Green house.
28 Hose for sprinkling lawn.
1 Hospital.
15 Hotels.
1 Laundry.
1 Lodging house.
6 Machine shops.
6 Offices.
1 Opera house.
2 Passenger depots.
1 Pipe works.
7 Planing mills.
3 Printing offices.
1 Restaurant.
2 Railroad round houses.
9 Saloons.
15 Salt works.
14 Saw mills.
1 Slaughter house.
2 Stables (hotels.)
6 Stables (livery.)
8 Stables (mill.)
16 Stables (private.)
2 Stables (street car.)
1 Woodenware works.
116 Water closets.

24 Pipes on which hydrants or hose connections are located for fire protection.

The following described premises are shut off:

1 Bank.
3 Barber shops.
8 Baths.
2 Blacksmith shops.
3 Boarding houses.
2 Business blocks.
1 Butcher shop.
119 Dwellings.
4 Drill houses.
1 Market garden.
3 Offices.
1 Planing mill.
2 Pasture lots.
1 Reel factory.
1 Roller rink.
11 Saloons.
2 Salt blocks.
1 Saw mill.

Elevators.
8 Hose for sprinkling lawns.
Hotels.
Hydrants.
Kindling factory.
9 Stables.
28 Stores.
16 Water Closets.
34 Vacant lots.

Water is supplied for the following described uses from which evenue is derived:

1 City building, police station and city offices.
6 City hose and truck houses and stables.
1 Public library building.
11 Water closets in city buildings.
7 Public watering troughs.
2 Ornamental fountains in public squares.
4 Hose for sprinkling public parks.

The water works department is entitled to credit for an amount al to what would be paid a private company for the above described s. Also for such rental for the public fire hydrants as is customarily l to private companies under similar circumstances where the works e been built by private enterprise.

The first ordinance adopted in this city fixing the water rates, fixed hydrant rental at $50 per year, per hydrant, which was certainly a y low rental as compared with what was paid in other cities.

The seven watering troughs and two ornamental fountains are using ually fully 25,000,000 gallons.

The rates on the city buildings, hose houses, etc., supplied, would ount to about $250 per annum.

This makes a credit to which the works are annually entitled as lows:

Rent of fire hydrants, 180	$ 9,000 00
Fountains and watering troughs	2,500 00
Other city uses	250 00
Total	$11,750,00

Cash Balances.

e balance in the water works fund, January 1st, 1886, was	$13,741 73
sh collections deposited with city treasurer to be credited to that fund	19,713 47
Total amount credited water works fund	$33,455 20

Amounts withdrawn from water works fund by requisition on the city recorder:

January 28th, requisition No.		203	$ 2,700 00
February 26th,	"	" 204	1,400 00
March 29th,	"	" 205	1,000 00
April 29th,	"	" 206	1,700 00
May 29th,	"	" 207	3,000 00
June 28th,	"	" 208	5,000 00
July 30th,	"	" 209	6,500 00
August 28th,	"	" 210	3,500 00
September 28th,	"	" 211	2,000 00
October 29th,	"	" 212	2,500 00
November 29th,	"	" 213	1,500 00
December 29th,	"	" 214	2,350 00
Total withdrawn			$53,150 00

Leaves balance in the water works fund December 31st, 1886		$ 305 2
The balance in the hands of the treasurer of the board January 1st, 1886, was	$ 675 49	
Amount deposited with treasurer, being sum drawn from water works fund	33,150 00	
Total amount charged treasurer		33,825 4
Orders drawn on treasurer by the secretary, (excepting time orders)		33,345 9
Leaves balance in hands of treasurer of board, December 31st, 1886		479 5
Total amount subject to the order of the board		785 0

Ledger Balances for 1886.

Ledger C.		Debit.	Credit
Folio 376,	Office expenses and salary account	$ 2,849 58	
" 376,	Repairs and care of hydrants, valves and pipes	607 07	
" 379,	Repairs and care of water meters	287 29	
" 381,	Care of reservoir and inlet works	279 25	
" 381,	Repairs to breakwater at bay	2,462 36	
" 384,	Engineers' and firemen's wages	3,480 00	
" 385,	Fuel account	3,315 00	
" 385,	Oil, packing and engineers' supplies	424 46	
" 387,	Repairs to pumping machinery	166 34	
" 382,	Repairs to engine foundations	13 50	
" 383,	Repairs to engine house	515 01	
" 389,	Implement account	178 75	
" 397,	Water meter account	629 72	

lio 396,	Breakwaters at bay	640 50	
398,	Pumping machinery	18,201 98	
399,	Engine foundations	1,004 52	
395,	Iron pipe and branch casting	6,477 57	
392,	Wyckoff pipe	6,179 72	
394,	Valve account	658 89	
395,	Fire hydrant account	453 85	
396,	Laying iron pipe	1,380 17	
393,	Laying Wyckoff pipe	1,030 96	
397,	House at bay shore	78 33	
359,	City treasurer		$ 13,436 53
366,	Orrin Bump, treasurer of board		195 68
394,	Bills payable		18,000 00
360,	Plumber's license		35 00
360,	Rents, dockage, etc		125 00
362,	Water rates roll of 1880		3 75
361,	" " " 1882		8 00
361,	" " " 1883		10 00
362,	" " " 1884		1 05
363,	" " " 1885		149 54
374,	" " " 1886		19,214 63
360,	Service tap account		85 64
		$ 51,264 82	$ 51,264 82

The following balance sheet shows the balance of each account m the commencement of the construction of the works to December st, 1886:

Ledger C.		Debit.	Credit.
io 482,	Real estate	$ 6,724 83	
482,	Dock, tramway and store shed	1,882 63	
482,	Engine house, chimney and wells	19,097 42	
483,	Engine foundations, boiler foundations and arches	5,936 24	
480,	Pumping machinery	57,873 05	
483,	Inlet from Saginaw river	3,218 99	
483,	Inlet from Saginaw bay	84,778 37	
480,	Reservoir, breakwaters and filter at bay	24,713 78	
479,	Iron pipe and branch castings	59,546 48	
479,	Wyckoff patent pipe	83,188 18	
477,	Laying pipe	36,467 32	
478,	Valves for street mains	9,842 66	
478,	Public fire hydrants	8,476 59	
488,	Buildings at bay shore	452 46	
476,	Water meters	10,002 16	
477,	Furniture and fixtures	646 93	
487,	Implements, for construction	1,713 61	
487,	Engineering and general superintendance	7,856 17	
487,	Travelling expenses, on construction	306 29	
488,	Insurance expenses, on construction	29 00	
488,	Interest, discounts and commissions	4,234 17	
412,	Office expenses and salaries	27,928 39	
416,	Repairs and care of hydrants, valves and pipes	8,064 48	
416,	Repairs to reservoir and breakwaters	6,741 63	
422,	Care of reservoir and inlet works	279 25	
421,	Repairs to inlet pipe from bay	17 94	
417,	Repairs to water meters	424 67	

Folio 412,	Engineers' and firemen's wages	48,992 84	
" 413,	Fuel account	40,224 61	
" 413,	Oil, packing and engineer's supplies	5,952 10	
" 414,	Repairs to pumping machinery	4,072 92	
" 414,	Repairs to boiler arches	664 08	
" 415,	Repairs to engine house and insurance	1,198 13	
" 421,	Repairs to engine foundations	51 45	
" 415,	Repairs to dock	13 38	
" 417,	Implements and tools, on repairs	1,129 37	
" 493,	Water works fund	305 20	
" 493,	Orrin Bump, treasurer	479 81	
" 491,	A. L. Stewart	15 00	
" 491,	Thomas Rosa estate	15 57	
" 408,	Water rates rolls of 1872-3 to 1880		$ 74,[illegible]
" 410,	Water rates roll of 1881		14,[illegible]
" 418,	" " " 1882		17,[illegible]
" 418,	" " " 1883		18,[illegible]
" 419,	" " " 1884		18,[illegible]
" 419,	" " " 1885		19,[illegible]
" 422,	" " " 1886		19,[illegible]
" 420,	Plumber licenses,		[illegible]
" 420,	Rents, dockage, etc		1,[illegible]
" 493,	Service tap account		1,[illegible]
" 476,	Service stop box account		[illegible]
" 494,	Bills payable		[illegible]
" 481,	Water assessment (frontage on pipe)		[illegible]
" 481,	Bay City bond account ($377,000 bonds)		[illegible]
		$ 573,348,16	$ [illegible]

The following table shows amount collected, amount uncollected, and total amount charged on roll, including metered water, for each year since the works commenced supplying water:

Year's roll.	Amount collected.	Amount uncollect'd	Total on roll.
1873, January 1st to April 30th	$ 728 83	$	$ [illegible]
1873-4, May 1st to April 30th	5,440 80	1 60	[illegible]
1874-5, May 1st to April 30th	6,9 8 16	44 85	[illegible]
1875, May 1st to December 31st	7,269 55	28 46	[illegible]
1876	9,571 26	82 73	[illegible]
1877	9,604 26	134 19	[illegible]
1878	10,078 15	324 71	[illegible]
1879	11,708 97	136 07	[illegible]
1880	13,150 74	130 25	[illegible]
1881	14,986 61	238 40	[illegible]
1882	17,333 27	188 05	[illegible]
1883	18,709 13	102 97	[illegible]
1884	18,887 27	137 39	[illegible]
1885	19,701 13	286 18	[illegible]
1886	19,214 63	260 72	[illegible]
Total	$183,292 75	$ 2,096 57	$[illegible]

Appended to this report will be found a summary of statistics of the works of this city compiled as near as may be in conformity with the form recommended by the New England water works association, also

tement of amount of material used in running the pumping engines, of consumers supplied through meters, and a copy of the report of ountant on examination of books for 1885.

In closing this report, which marks the termination of fifteen years continuous service in the same position, I desire to thank your orable board for the universal courtesy and kindness of which I have n the recipient, both from the present members and those who have ceded them, also all the employes of the board, who have cheerfully d every effort to assist me in the performance of my duties, and to in the efficient and economical management of the works.

Respectfully submitted,

E. L. DUNBAR,

Superintendent and Secretary.

Bay City, February 5th, 1887.

REPORT OF ACCOUNTANT ON EXAMINATION OF BOOKS OF 1885.

BAY CITY, MICH., February 25th, 1886.

THE HONORABLE BOARD OF WATER COMMISSIONERS OF THE CITY OF BAY CITY:

GENTLEMEN—I, the undersigned accountant, employed to audit books and accounts of the Bay City Water Works for the year 1885, g leave to submit the following report:

I have examined the records, vouchers, accounts and books of the retary, also the several statements as shown on the superintendent's inted report,

Folio 23, Receipts.	Folio 24, Expenditures.
Folio 28, Balances.	Folio 29, Ledger Balances, 1885.

nd find them all correct.

I have also examined all assessment rolls and compared same with ubs of receipts, and found them to agree perfectly with each other, d daily record of same.

All of which is respectfully submitted.

[Signed,] CHAS. PENRY REES.

Summary of Statistics.

Bay City, Bay County, Michigan, Water Works.
Population by census of 1884, 29,415.
Date of construction, 1872.
Works owned by the city.
Source of supply, Saginaw Bay, an arm of Lake Huron.
Mode of supply, direct pumping.

Pumping.

1. Builders of pumping machinery, Holly Manufacturing Co., of Lockport, N. Y.
2. Description of fuel. Pine slabs and edgings. Cost per cord, $1.
3. Fuel consumed for the year 3,324¾ cords; equal to soft coal, 2,216,500 lbs.
6. Total pumpage in gallons, 779,761,852.
8. Average head against which pumps work, 108.5.
9. Number of gallons pumped per lb. of coal, 352.
10. Duty. $= \frac{779{,}761{,}852 \times 8.34 \times 100 \times 108.5}{2{,}216{,}500} = 31{,}833{,}914.$

Cost of pumping figured on pumping station expenses, viz.: $7,436.4

11. Per million gallons pumped, $9.54.
12. Per million gallons raised one foot high, $0.0879.

Cost of pumping figured on total maintenance, viz.: $14,528.61.

13. Per million gallons pumped, $18.62.
14. Per million gallons raised one foot high, $0.1716.

Financial.—Maintenance.

RECEIPTS—DIVISION I.		EXPENDITURES.	
From consumers—		A. A.—Management and repairs	$14,609 47
A.—Water rates, domestic	$14,927 19	B. B.—Interest on bonds paid by city treasurer	30,160 00
B.—Water rates, manufacturing	4,459 78		
C.—Net receipts from water	$19,386 97	C. C.—Total maintenance for year	$44,769 47
D.—Service taps, rents, etc	326 50	D. D.—Balance to construction	5,104 00
E.—Total	$19,713 47		
From public funds—			
J.—Tax levy for interest on bonds	$30,160 00		
Total	$49,873 47	Total	$49,873 47
From fixed rates—			
L.—Domestic	$12,075 62		
M.—Manufacturing	650 00		
N.—	$12,725 62		
From meter rates—			
O.—Domestic	$ 2,851 57		
P.—Manufacturing	3,809 78		
Q.—	$ 6,661 35		

Construction.

RECEIPTS.		EXPENDITURES.	
R.—From balance of previous years	$14,417 22	F. F.—Extension of mains	$16,181 16
S.—From bills payable	18,000 00	H H.—Pumping machinery	18,201 98
U.—From balance from maintenance	5,104 00	Foundations	1,004 52
		Breakwaters	640 50
		Building	78 33
		Meters	629 72
		I. I.—Total construction	$36,736 21
		J. J.—Balance	785 01
Total	$37,521 22	Total	$37,521 22

W.—Net cost of works to date	$426,777 33	
X.—Bonded debt, city bonds	377,000 00	Interest 8 per cent.

CONSUMPTION.

1. Estimated population at date, 32,000.
2. Estimated population on lines of pipe, 15,000.
3. Estimated population supplied, 10,000.
4. Total gallons consumed, 779,761,852.
5. Passed through domestic meters, 30,981,127 gallons or 4 per cent.
6. Passed through manufacturing meters, 46,053,194 gallons, or 6 per cent.
7. Average daily consumption, 2,136,[illegible] gallons.
8. Gallons per day to each inhabitant, 6.
9. Gallons per day to each consumer, [illegible].
10. Gallons per day to each tap, 1,675.

DISTRIBUTION.

MAINS.

1. Cast iron and Wyckoff patent.
2. Sizes, from 3 to 20 inches.
3. Extended, 13,514¼ feet.
4. Removed, 421 feet.
5. Total in use, 24¾ miles.
6. Cost of repairs, $5.85 per mile.
7. Leaks per mile, 1.2.
8. Small distribution, less than 4-inch, 319 feet.
9. Hydrants added, 20.
10. Number in use, 180.
11. Stop gates added, 36.
12. Number in use, 348.
13. Small stop gates less than 4-inch, 1.
14. Number of blow-off gates, 19.

SERVICES.

16. Lead, iron and Wyckoff.
17. ¾-inch to 8-inch.
21. Services added, 38.
22. Number in use, 1,276.
25. Meters added, 20.
26. Number in use, 174.
    Domestic, 104.
    Manufacturing, 56.
    Trial, 14.
27. Motors and elevators added, 1.
28. Number in use, 2.

Material used in running pumping engines during the year 1886:

3,324¾ cords of slabs	costing	$3,324 75
157½ gallons cylinder oil	"	107 56
37 lbs. royal lubricant	"	8 65
7½ gallons of lard oil	"	6 13
2½ lbs. plumbago	"	62
18 13-16 lbs. 1-inch square packing	"	13 17
1⅝ lbs. ⅝-inch square packing	"	79
7½ lbs Eureka packing	"	4 50
4 7-16 lbs. ring packing	"	7 00
17 13-16 lbs. sheet rubber	"	8 62
9¼ lbs. Heston cone packing	"	13 88
9 lbs. hemp packing	"	2 25
16½ lbs. cotton packing	"	6 60
17 lbs. valve leathers	"	10 85
15 lbs. valve rivets	"	2 25
10 lbs. red lead	"	1 00
1 gallon boiled oil	"	65
712 lbs. wipers	"	49 84
6 boxes concentrated lye	"	75
½ gallon turpentine	"	30
13 brooms	"	3 25
509 gallons kerosene oil	"	55 83
Lamp-wicks and lamp-chimneys	"	3 75
Matches	"	93
281 lbs. British scale eradicator	"	58 35
207 lbs. Eureka boiler compound	"	16 56
200 lbs. Boston compound	"	31 16

7½ lbs. gaskets for boilers	costing	$	3 75
Tripoli, rotten stone, acid and emery	"		1 45
Oilers, hand-lamps, hose, etc	"		25 81
Soap and ice	"		19 00
Total		$3,790	15

aterial on hand December 31st, 1886:

25¾ cords slabs and edgings	costing	$	25 75
9 gallons cylinder oil	"		8 10
13 lbs. royal lubicant	"		2 60
½ gallon lard oil	"		38
1 lb. plumbago	"		25
7 lbs. 1-inch square rubber	"		3 71
8 lbs. ½-inch square rubber	"		3 04
12½ lbs. gaskets for boilers	"		6 25
6 lbs. sheet rubber	"		3 50
6 lbs. Heston cone packing	"		9 00
17 lbs. hemp packing	"		4 25
10 lbs. cotton packing	"		4 00
7½ lbs. wicking	"		3 00
13 lbs. valve leathers	"		13 00
5 lbs. red lead	"		50
4 brooms	"		1 17
28 gallons kerosene oil	"		2 94
18 lamp chimneys	"		1 10
5 dozen lamp wicks	"		27
85 boxes matches	"		85
62 lbs. British scale eradicator	"		12 40
206 lbs. Eureka boiler compound	"		16 48
63 bars soap	"		2 50
1 air pump valve	"		3 20
Total		$128	24

List of consumers supplied through meters December 31st, 1886.

Domestic Meters.

Name of consumer.	Use.	Kind and size.	Cost, set.
John Wald	Dwelling	Empire ½-inch	$ 15 75
F. Hamme & Co	Bakery	Empire ½-inch	17 50
Franklin Johndrew	Hotel	Crown ½-inch	18 30
Louis Cormier	Hotel	Crown ½-inch	17 33
Michigan Central Railroad Co	Passenger depot	Crown ¾-inch	25 20
A. Cunning	Hotel	Empire ½-inch	22 50
Alex Trombley	Dwelling	Empire ½-inch	19 00
E. Eickemeyer	Block	Crown ¾-inch	28 95
W. J. Schirley	Hotel	Crown ¾-inch	28 44
C. A. Jay	Hotel	Crown ¾-inch	38 00
C. A. Jay	Hotel	Crown ¾-inch	28 00
C. A. Jay	Hotel	Crown ½-inch	18 09
C. A. Jay	Hotel	Crown ¾-inch	15 75
Geo. H. Phelps	Saloon	Union Rotary ⅝-inch	20 00
Becktel & Son	Hotel	Crown ¾-inch	29 07
A. N. Rouech	Hotel, etc	Crown 1-inch	36 31
Mrs. H. S. Benson	Block	Crown ¾-inch	27 00
Mrs. H. S. Benson	Block	Crown ½-inch	16 90

L. H. Griffin	Block	Crown ¾-inch	25 67
Henry Birney	Livery	Crown ⅜-inch	25 58
E. E. Burroughs	Livery	Crown ½-inch	18 66
H. Schindehette	Hotel	Crown ¾-inch	35 31
Peter LaFrance	Livery	Crown ¾-inch	21 38
Hurley Bros	Block	Empire ½-inch	17 25
Geo. Cook	Hotel	Crown 1-inch	42 79
Robert J. Parker	Hotel	Crown ½-inch	22 12
William P. Root	Hotel	Crown ¾-inch	29 77
H. Tupper, M. D	Dwelling	Crown ¾-inch	40 08
H. Tupper, M. D	Stable	Crown ½-inch	22 50
Bay County Milk Association	Creamery	Empire ½-inch	20 70
Bay County	Court house	Crown 1-inch	72 64
Mrs. J. Ramsdell	Dwelling	Empire ¾-inch	26 00
F. & P. M. R. R Co	Passenger depot	Crown ¾-inch	30 00
F. E. Tyler	Dwelling	Empire ⅛-inch	14 50
Jas. B. Shearer	Dwelling	Crown ½-inch	25 02
B. E. Warren	Dwelling	Crown ¾-inch	35 42
T. E. Webster	Dwelling	Crown ½-inch	17 97
Trinity church	Church	Crown ½-inch	14 87
John Drake	Dwelling	Duplex ⅝-inch	19 44
C. H. Shearer	Dwelling	Crown ½-inch	25 69
Charles A. Eddy	Dwelling	Crown ¾-inch	29 55
Charles H. Bradley	Dwelling	Empire ¾-inch	32 45
N. Dunham	Dwelling	Empire ¾-inch	26 32
C. C. Whitney	Dwelling	Crown ½-inch	17 00
H. Griswold	Dwelling	Crown ½-inch	14 47
Jas. McKeon	Dwelling	Empire ½-inch	15 48
W. E. Teall	Dwelling	Empire ½-inch	14 35
Orrin Bump	Dwelling	Empire ½-inch	14 00
Geo. B. Armstrong	Dwelling	Empire ½-inch	15 30
A. B. Paine	Block	Crown ½-inch	14 87
Mrs. C. B. Cottrell	Block	Union Rotary ⅝-inch	30 45
Hurley Bros	Block	Empire ½-inch	24 15
J. F. Antisdel	Hotel	Empire 1-inch	30 00
J. F. Antisdel	Hotel	Crown 1-inch	40 00
J. F. Antisdel	Hotel	Union rotary ¾-inch.	26 09
Young Bros	Stable	Empire ¾-inch	27 70
F. E. Tyler	Livery	Crown ¾-inch	28 90
William Coons	Livery	Crown ½-inch	18 98
Bay City Building Co	Block	Empire ¾-inch	29 85
Bay City Building Co	Block	Crown 1-inch	32 75
Woods Opera House Co	Block	Crown 1-inch	40 90
F. E. Bradley	Dwelling	Empire ¾-inch	26 70
Gustaves Hine	Dwelling	Empire ½-inch	19 50
Peter Kelson	Hotel	Crown ½-inch	21 42
John McDermott	Block, etc	Empire ½-inch	30 47
Wm. LaBeau	Hotel	Empire ¾-inch	27 09
W. D. Sherman	Livery	Empire ¾-inch	23 35
Bay County	Jail, etc	Crown ¾-inch	32 40
S. M. Green	Dwelling	Empire ¾-inch	26 50
John Thompson	Dwelling	Crown ½-inch	19 41
R. W. Erwin, M. D	Dwelling	Empire ¾-inch	25 27
Wm. McEwan	Dwelling	Empire ¾-inch	30 72
Wm. McEwan	Stable	Crown ½-inch	19 77
Geo. Young	Dwelling	Crown ¾-inch	29 75

W. D. Young	Dwelling	Empire ¾-inch	26 75
A. Mosher, jr	Dwelling	Duplex ⅝-inch	19 53
Walter P. Moore	Dwelling	Empire ⅝-inch	15 50
W. I. Brotherton	Dwelling	Crown ⅝-inch	14 61
A. A. Knopfel	Dwelling	Crown ⅝-inch	16 57
S. T. Holmes	Stable, etc	Worthington 1½-inch	56 58
John K. Mason	Dwelling	Crown ⅝ inch	14 87
John McEwan	Dwelling	Crown ⅝-inch	17 38
D. L. Westover	Dwelling	Empire ¾-inch	22 00
J. L. Ambrose, M. D	Dwelling	Empire ⅝-inch	14 90
Bay City Street R. R. Co	Stable	Empire ¾-inch	26 00
Chas. Breitmeyer	Dwelling, etc	Crown ¾-inch	28 70
Jas. Clements & Son	Office, etc	Union Rotary 1-inch	27 25
Edward Stenger	Bakery	Empire ⅝-inch	18 90
Edward Atkinson	Dwelling, etc	Empire ⅝-inch	19 05
James Birney	Dwelling, etc	Empire ⅝-inch	15 70
Northwestern Hospital Co	Hospital	Empire ¾-inch	24 15
Thomas Shiler	Dwelling, etc	Empire ¾-inch	25 00
J. J. Hine	Hotel	Empire ⅝-inch	17 50
C. R. Fancher & Co	Hotel	Crown 1-inch	42 49
Bay City Street R. R. Co	Stable	Crown 1-inch	45 02

MANUFACTURING METERS.

Name of consumer.	Use.	Kind and size.	Cost, set.
McEwan Bros. & Co	Mill etc	Union Rotary 3-inch	$ 159 55
Dolsen, Chapin & Co	Drill house	Crown ¾-inch	29 26
" " "	Mill, etc	Union Rotary 3-inch	164 54
" " "	Salt block	Union Rotary 2-inch	105 61
Eddy Bros. & Co	Mill, etc	Union Rotary 3-inch	156 29
Folsom & Arnold	Mill, etc	Union Rotary 4-inch	270 15
" "	Drill house	Union Rotary 3-inch	155 32
Edmund Hall	Mill, etc	Union Rotary 2-inch	82 14
" "	Drill house	Crown ¾-inch	29 00
" "	Stable, etc	Crown ½-inch	18 19
The Michigan Pipe Co	Pipe Works	Union Rotary 4-inch	280 87
" " "	Pipe Works	Union Rotary 3-inch	133 38
C. Hiller	Planing mill	Crown ¾-inch	27 32
F. & P. M. R. R. Co	Round-house, etc.	Crown 1-inch	38 94
Bay City Iron Co	Machine shop	Crown 1-inch	37 24
M. C. R. R. Co	Round-house	Worthington 2-inch	67 47
Pitts & Cranage	Planing mill	Union Rotary 3-inch	127 18
" "	Mill, etc	Union Rotary 4-inch	243 21
" "	Salt block, etc	Union Rotary 3-inch	132 27
George Ford	Machine shop	Crown ¾-inch	33 35
L. M. Ross	Carriage shop	Empire ¾-inch	26 40
Bay City Tribune	Printing office	Crown ¾-inch	29 15
Evening Star Co	Printing office	Crown ½-inch	17 65
S. G. M. Gates	Mill, etc	Union Rotary 3-inch	126 35
" " "	Office	Crown ½-inch	20 49
" " "	Stable	Empire ¾-inch	23 77
C. B. Chatfield	Flour mill	Empire ¾-inch	25 94
F. E. Bradley & Co	Mill, etc	Union Rotary 4-inch	238 32
McKim Bros	Machine shop	Crown ½-inch	18 36
Swift Electric Light Co	Electric Lt. Wks	Worthington 1⅛-inch	52 10
Eddy, Avery & Eddy	Hydrants, etc	Union Rotary 3-inch	126 25
" " "	Cooper shop, etc	Crown ¾-inch	29 09
" " "	Mill, etc	Union Rotary 3-inch	132 75

Eddy, Avery & Eddy	Mill, etc	Crown ¾-inch	
Eddy, Avery and Eddy and Smalley Bros. & Co., Drill houses and machine shops		Union Rotary 3-inch.	
McKinnon Manufacturing Co.	Machine shop	Crown ¾-inch	
Industrial Works	Machine shop	Union Rotary 3-inch	
Wm. Peter	Mill, etc	Union Rotary 3-inch	
N. B. Bradley & Son's	Mill, etc	Union Rotary 3-inch	
Mathew Lamont	Planing mill	Worthington 1¼-inch	
Mathew Lamont	Planing mill	Empire ¾-inch	
Ross, Bradley & Co	Planing mill	Crown 1½-inch	
N. B. Bradley & Son's	Drill house	Union Rotary 1½-inch	
Butman & Rust	Mill, etc	Union Rotary 2-inch	
" "	Salt block	Crown 1-inch	
Rust Bros. & Co	Salt block	Union Rotary 1-inch	
" " "	Mill, etc	Union Rotary 3-inch	
" " "	Hydrants	Union Rotary 4-inch	
Gustaves Hine	Slaughter house	Empire ½-inch	
Bay City Brewing Co	Brewery	Crown 1-inch	
" " "	Brewery	Crown 1-inch	
" " "	Brewery	Crown 1-inch	
Standard Machinery Co	Machine shop	Worthington 2-inch	
S. McLean & Son & Co	Mill, etc	Union Rotary 2-inch	
" " "	Office	Crown ½-inch	
" " "	Salt block	Crown 1-inch	
Miller & Lewis	Mill, etc	Union Rotary 3-inch	
" "	Salt block	Crown ¾-inch	
" "	Drill house	Crown 1-inch	
Ben H. Briscoe & Co	Planing mill	Worthington 1¼-inch	
Bousfield, Perrin & Co	Woodenware Wks.	Union Rotary 3-inch	
Michigan Fire Lighter Co	Kindling factory	Worthington 1¼-inch	
R. M. Bradley	Planing mill	Union Rotary 3-inch	
T. H. McGraw & Co	Salt block, etc	Union Rotary 8-inch	
J. L. Gould	Market garden	Union Rotary 2-inch	

Test or Trial Meters.

Location of pipe.	Kind and size.	Cost.
McEwan Block, Water street, water closets	Union Rotary ¾-inch.	$
Jas. Shearer, Central block	Worthington 1¼inch.	
Shearer Bros. block	Union Rotary 1-½inch	
Van Den Brooks block, water closets	Crown ½-inch	
Fifth street, north side, west of Johnson street	Crown 1-inch	
Between Farragut and Sherman Sts, north of Center	Crown 1-inch	
Between Hampton and McClellan St. south of Center	Crown 1-inch	
Between Eighth and Ninth Sts., east of Grant St	Crown 1-inch	
Seventh street, east of Van Buren	Empire 1-inch	
Between Saginaw and Washington streets, south of Tenth street	Crown 1-inch	
North side Eleventh street, east of Jefferson	Crown ¾-inch	
South side Eleventh street, east of Jefferson	Empire 1-inch	
Between Madison and Monroe Sts., south of Tenth.	Empire 1-inch	
Between Monroe and Jackson Sts, south of Thirteenth	Crown ¾-inch	
Elevator indicator in Shearer's Central block		
Labor on 17 meters taken out		
Fittings and lumber, per inventory		
Meters on hand, per inventory		
Total		$

Sixteenth

ANNUAL REPORT

—OF THE—

SUPERINTENDENT * *

—OF—

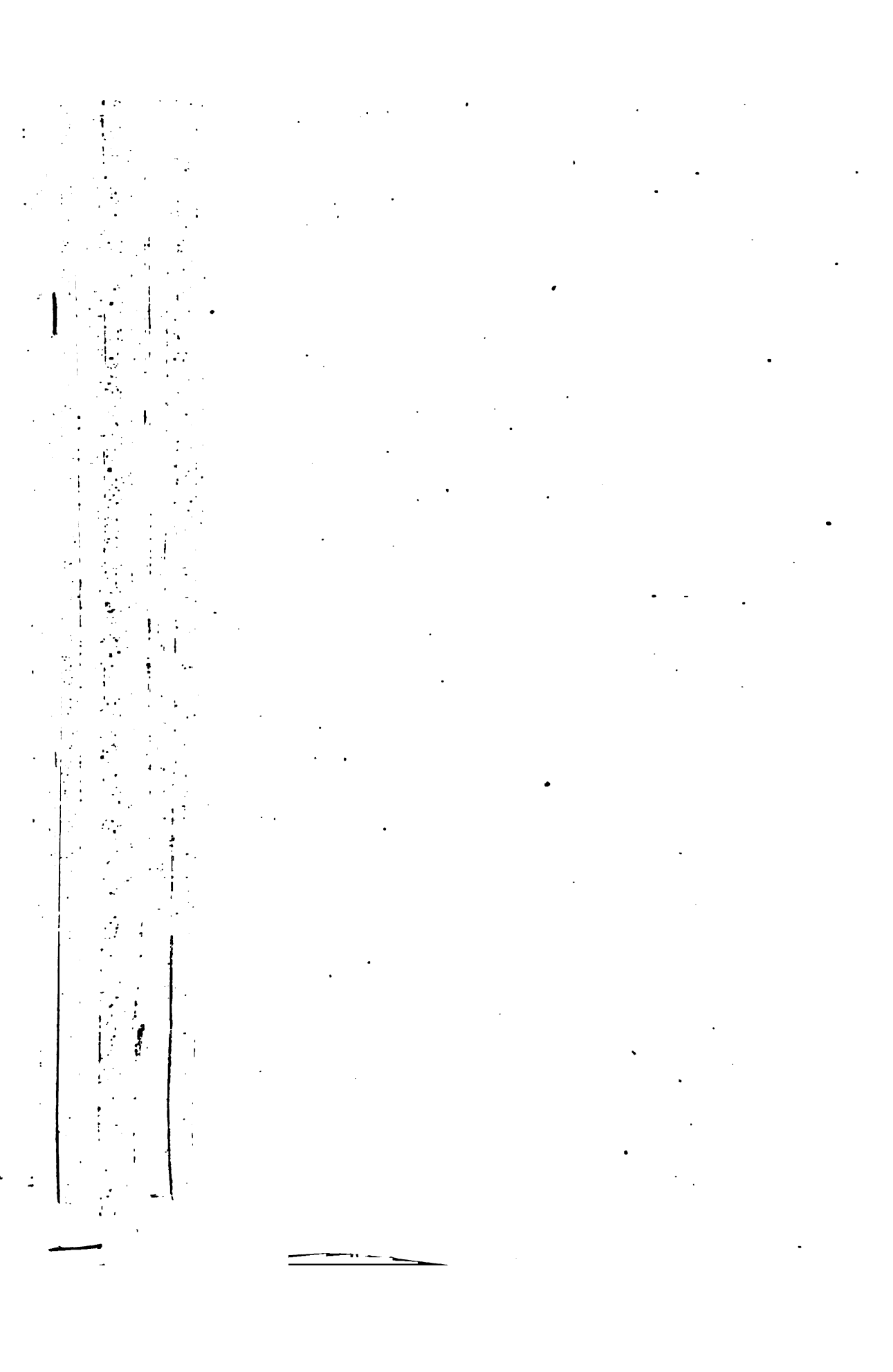
* * WATER * WORKS,

Bay City, Mich.,

For 1887.

BAY CITY, MICH.:
TRIBUNE BOOK AND JOB ROOMS.

1888.



Compliments of

E. L. Dunbar, Supt.

PLEASE EXCHANGE.

ANNUAL REPORT

—OF THE—

SUPERINTENDENT * *

—OF—

* * WATER * WORKS,

Bay City, Mich.,

For 1887.

BAY CITY, MICH.:
TRIBUNE BOOK AND JOB ROOMS.
1888.





CITY OF BAY CITY, MICHIGAN.

Water Department.

1887.

Commissioners.

ANDREW WALTON, President.
(Term expires September 6th, 1894.)
G. HENRY SHEARER.
(Term expires September 6th, 1888.)
BENJAMIN F. RAY.
(Term expires September 6th, 1889.)
JOHN D. McKINNON.
(Term expires September 6th, 1890.)
LOUIS MORITZ.
(Term expires September 6th, 1891.)
DUNCAN McGREGOR.
(Term expires August 4th, 1889.)
GEORGE C. MYERS.
(Term expires August 4th, 1890.)

Superintendent and Secretary, E. L. DUNBAR.
Office Assistant, THOMAS A. DELZELL.
Inspector, FRANK H. COLLINS.
Reservoir Keeper, LEVI D. CARPENTER.

PUMPING DEPARTMENT.

A. B. VERITY.....First Engineer.
FRED H. HOLLY.....Second Engineer.
PATRICK O'HARE.....Fireman.
A. J. CARPENTER.....Fireman.

To the Honorable Board of Water Commissioners of Bay City, Michigan:

Gentlemen—I beg leave to submit herewith my report for the year ending December 31st, 1887, being the sixteenth annual report of this department.

Commissioner Andrew Van Den Brooks having removed from the city, tendered his resignation as a member of the board to the common council on the 21st day of March, 1887, and at a regular session of the council held May 9th, 1887, Mr. Louis Moritz was appointed to fill the vacancy. The term of office of Commissioner Andrew Walton expired September 6th, 1887. This vacancy was filled October 10th, 1887, by the reappointment of Mr. Walton.

At a regular meeting of the board held October 25th, 1887, Commissioner Walton was re-elected president. Several changes were made in the ordinance governing the board during the months of January and February, 1887, some of which were exceedingly objectionable to the board, appearing to reflect severely upon their management, and so restricting their powers as, in their opinion, to seriously interfere with the efficiency of the department. This was evidently not the intention of the common council in making these changes, and they were so modified as to be acceptable to both the common council and the water board. By mutual agreement the ordinance as finally amended was embraced in the act amending an act incorporating this city, adopted by the Legislature of the State of Michigan, approved April 16th, 1887, and constitutes sections 151 to 159, inclusive, of the city charter.

Under the ordinance the membership of the board consisted of one from each ward, and the length of the term of office was five years, the members from the Sixth and Seventh wards retiring on the same years as the members from the Third and Fourth wards.

By the amendments to the charter adopted at the same time that the water works ordinance was incorporated therein, the number of wards in the city was increased to eleven, and it was not deemed ad-

visable to make a corresponding increase in the number of members of the board. Such changes were therefore made as would continue the number of members constituting the board at seven. The several members then constituting the board were continued in office until the expiration of their term under the ordinance, and as fast as vacancies occurred they were to be filled by appointment from the city at large, and for a period of seven years. As the charter now reads, the term of office of Commissioners Ray and McGregor will expire in 1889, and that of Commissioners McKinnon and Myers in 1890, and no vacancy will occur by limitation in 1892 or 1893.

I beg leave to suggest that if any other amendments to the charter are requested at the next session of the Legislature, section 151 be so amended as to continue the term of office of Commissioners McGregor and Myers until September 6th, 1892, and September 6th, 1893, respectively.

FINANCIAL.

The cash receipts of the department from all sources during the year were $19,954.10, an increase of $240.63 from the preceding year. This increase is mainly in assessment rates for water, the amount received for metered water showing a falling off of about $150.00, notwithstanding an increase in the number of meters on which rates are charged from 160 to 180.

The quantity of water supplied through meters has been about 4,600,000 gallons less than during 1886, indicating that consumers are finding it more economical to prevent unnecessary waste than to pay for it.

The average price received for metered water supplied during 1887 was abouts 9 cents per thousand gallons, against 8 6-10 cents per thousand in 1886.

The receipts of the department during the year have been from the following described accounts:

Water rates roll of 1882	$ 1 00	
" " " 1883	3 00	
" " " 1884	1 00	
" " " 1885	8 87	
" " " 1886	67 80	
" " " 1887	19,299 56	
Total for water rates		$19,381 23

Plumber licenses	50 00
Rent of boom	200 00
Service connections	250 50
Sale of old coping stone	15 00
Sale of building stone	54 87
Damage to boat	3 00
Total cash collections	$19,954 10

This amount has been deposited with the city treasurer to be aced to the credit of the water works fund as per receipts on file as llows:

January 31st, 1887	$ 1,589 00
February 28th, "	963 37
March 31st, "	1,466 92
April 30th, "	2,306 79
May 31st, "	935 53
June 30th, "	1,451 77
July 30th, "	2,307 76
August 31st, "	970 43
September 30th, "	1,605 63
October 31st, "	2,671 61
November 30th, "	1,298 64
December 31st, "	2,386 65
	$19,954 10

The expenditures of the department for the year have been 5,323.25, of which $11,739.29 was for maintenance accounts, and ,583.96 for construction accounts.

The cost of maintenance has been less than for any previous year ıce 1882. This is due largely to the saving in fuel from operating e Gaskill pumping engines, which have fully met our expectations d maintained the reputation they have obtained wherever used for onomical use of steam. The saving in fuel alone was about $1,300.00 ɔm the year 1886, when the Gaskill engines were in operation about ro months, and fully $1,500.00 from 1885, which was the last year at the quadruplex engines were in operation the entire year.

The expenditures have been for the following accounts:

ɔr maintenance account—

Office department:

Salaries	$ 2,412 50	
Expenses	365 67	
		$ 2,778 17

Street and service department:

Repairs on main distribution	$ 668 44
Repairs on services and shut-offs	279 14

Repairs and care of water meters	196 58	
Repairs and care of inlet works	423 07	
Service connections	103 11	
		1,670 34

Pumping department:

Salaries	$ 3,480 00	
Fuel	2,087 97	
Oil, packing and supplies	318 29	
Repairs to pumping machinery	470 20	
Repairs to boiler arches	264 32	
		6,570 78

Interest account—

Interest on time orders		720 00
Total for maintenance accounts		$11,739 29

For construction accounts—

Main distribution:

Iron pipe and branch castings	$ 52 38	
Wyckoff patent pipe	1,988 92	
Valves	125 92	
Hydrants	394 50	
Laying pipe	415 81	
		$ 2,977 53

Water meter account—

Meters and setting		450 90

Furniture and fixtures:

Office furniture	114 01	
On account of vault in library building	41 52	
		155 53
Total tor construction account		$ 3,583 96
Total expenditures		$15,323 25

These expenditures have been reported to the Common Council each month, as follows:

January	$ 876 98
February	935 27
March	1,723 38
April	876 39
May	1,471 29
June	1,215 74
July	1,889 43
August	1,725 99
September	817 16
October	1,647 70
November	1,240 47
December	908 45
	$15,323 25

The details of these expenditures are as follows:

Office department—

Salaries:

Salary of superintendent and secretary	$ 1,800 00
Office assistant	600 00

Treasurer from January 1st to February 14th	12 50	
		$ 2,412 50

Expenses:

Postal cards and postage stamps	$ 66 50	
Blank books, account memoranda, etc	29 10	
Printed blanks, receipts, orders, pay-roll, etc	39 75	
Publishing report of 1886	52 50	
Stationery, ink, pens, etc	29 10	
Accountants examining books, 1886	37 75	
Rent of telephones (2)	80 00	
Binding foreign reports	3 00	
Coal and cleaning office	8 70	
Repairs on old office, papering, etc	23 15	
Exchange on drafts, telegrams, etc	3 77	
Keys, stamps, etc., new office	1 35	
		365 67

Street and service department—

Repairs on main distribution:

Repairing leaks in main pipes	$ 162 48	
Changing grade of pipes and hydrants	76 27	
Raising pipe caved in by workmen	15 85	
Placing nuts on valves and renewing valve boxes	180 96	
Repairing hydrants and valves	50 62	
Threading and changing hydrant nozzles	26 00	
Examining, repacking and blowing off hydrants	102 95	
Repairing leaks in service connections and refilling trenches, etc	12 57	
Tools for street work and repairs	40 74	
		668 44

Repairs and care of services:

Labor examining services and shutting off	$ 260 86	
Repairing 2 taps and replacing 9	10 88	
Threading corporation cocks taken out	3 00	
Repairing 2 service pipes	4 40	
		279 14

Repairs and care of inlet works:

Salary of reservoir keeper	$ 420 00	
Small tools and repairing tools	3 07	
		423 07

Repairs and care of water meters:

Reading, examining and cleaning meters	$ 145 82	
Taking out, removing and resetting	15 75	
Repairs on broken meters, dials, covers, etc	33 11	
Tools	1 90	
		196 58

Service connections:

1 dozen 1-inch corporation cocks	$ 18 01	
1 dozen ¾-inch corporation cocks	13 88	
1½ dozen ½-inch corporation cocks	17 65	
Labor putting in branches and service connections	53 01	
1 gross screws	56	
		103 11

Pumping department—

Salaries:

First engineer's salary	$ 1,200 00	
Second engineer's salary	960 00	
Two firemen, each $660	1,320 00	
		3,480 00

Fuel account:

1,132 cords slabs at $1	$ 1,132 00	
6 cords slabs at 90 cents	5 40	
130 cords slabs at 70 cents	91 00	
980 cords slabs at 80 cents	784 00	
7 tons of coal	25 57	
		2,037 97

Oil, packing and supplies:

Cylinder oil and lubricants	$ 198 13	
Packing	66 95	
Wipers and cleaning material	50 19	
Kerosene oil, wicks and chimneys	44 72	
Ice	13 75	
Files, oilers, etc	14 55	
		318 29

Repairs to pumping machinery:

Boiler inspection	$ 15 00	
Repairing boilers	397 99	
Repairing feed pipes	15 30	
Repairing air pump on quadruplex	18 07	
New bleeder pipes and paint (Gaskill engine)	21 45	
Bolts, belting, etc	2 39	
		470 20

Repairs to boiler arches:

Tearing out and rebuilding No. 1 arch	$ 219 87	
Bolts, side door, coverplate, etc	37 83	
Repairing arch No. 2 boiler	7 12	
		264 32

Interest account—

Interest on $18,000 bills payable at 4 per cent		720 00

Main distribution—

Wyckoff pipe:

3,967 feet 2 inches of new 6-inch pipe	$ 1,955 81	
18 feet of old 6-inch pipe repaired and relaid	1 77	
Four 6-inch sleeves	11 28	
One 4-inch sleeve	1 88	
45 feet 6 inches of new 4-inch pipe	13 88	
Extra thimbles, plugs, etc	4 35	
		1,988 92

Iron pipe and branch castings:

One 4x4-inch tee	$ 3 79	
Eight 6x4-inch tees	35 30	
Two 6x6-inch crosses	13 29	
		52 38

Valves:

Eight 4-inch valves	$ 72 00	
Two 6-inch valves	28 00	
Four iron valve boxes at $3.50	14 00	
Five iron valve boxes at $2.25	11 25	
Two wood valve boxes	42	
Freight	25	
		125 92

Fire hydrants:

Three Gaskill hydrants, set in 1886	$ 79 50	
Five Holly hydrants with slide valves	182 50	
Five Holly hydrants	182 50	
		394 50

Laying pipe:

Labor, trenching and laying pipe	$ 411 61	
Repairing tools	1 00	
Timber for bracing	70	
Boring iron pipe connection	2 00	
Drayage	50	
		415 81

Water meters:

New meters	$ 378 70	
Connections, fittings and boxing	26 49	
Setting meters	45 71	
		450 90

Furniture and fixtures—

Chairs for engine house	$ 3 00	
Table, shelves, etc., for office	18 70	
Recording gauge in office and express	77 20	
Molding, water pipe, etc., new office	15 11	
On account of building vault at new office	41 52	
		155 53

In addition to the expenditures of the Board as above, the City Treasurer has paid, from monies raised by tax levy, the interest on the bonds issued for water works purposes, amounting to $30,160, and has also paid with funds derived from the same source $10,000 of the bonds which matured on the first day of October, 1887.

The amount of water works bonds outstanding is $367,000, drawing interest at the rate of 8 per cent. per annum, besides $18,000 in time orders issued in payment for pumping machinery, drawing interest at the rate of 4 per cent. per annum.

The total amount received by the Board from all sources since its organization in 1871 has been as follows:

Received from city, proceeds of $377,000 in bonds	$368,045 87
Received from city, frontage tax (assessed one year)	736 07
Water rates collected	209,673 98

Net receipts from service connections, etc		3,670 86
Bills payable		18,000 00
		$593,126 78

Expenditures:

For construction accounts	$430,321 92	
For maintenance accounts	157,389 00	
		587,710 92
Balance		$ 5,415 86

The following table shows the amount of water rates collected on each year's roll since the works commenced operations, with the amount remaining uncollected December 31st, 1887, and total amount charged on roll:

YEAR'S ROLL.	COLLECTED.	UNCOLLECTED.	TOTAL ON ROLL.
1873, January 1st to April 30th	$ 728 82	.....	$ 728 82
1873-4, May 1st, 1873, to April 30th, 1874	5,440 80	$ 1 60	5,442 40
1874-5, May 1st, 1874 to April 30th, 1875	6,908 16	44 85	6,953 01
1875, May 1st to December 31st	7,269 55	28 46	7,298 01
1876	9,571 26	82 73	9,653 99
1877	9,604 26	134 19	9,738 45
1878	10,078 15	324 71	10,402 86
1879	11,708 97	136 07	11,845 04
1880	13,150 74	130 25	13,280 99
1881	14,986 61	238 40	15,225 01
1882	17,334 27	187 05	17,521 32
1883	18,712 13	99 97	18,812 10
1884	18,888 27	136 39	19,024 66
1885	19,710 00	277 31	19,987 31
1886	19,282 43	192 92	19,475 35
1887	19,299 56	223 69	19,523 25
Totals	$202,673 98	$ 2,238 59	$204,912 57

Assessment rates for 1888 amount to $12,872, an increase of $184 over the footings of the roll of 1887 on January 1st of that year, in addition to which, premises charged assessment rates January 1st, 1887, to the amount of $119 per annum, are now supplied through meters and not included in assessment rates for 1888.

Twenty-two of the new services put in during the year are metered.

Under the ordinance in force since the organization of the Board until the amendments hereinbefore referred to were adopted, requisition was made on the City Recorder once in each month for such amount as the Board estimated would be required to pay accounts falling due at the close of the month, and this amount was deposited with the Treasurer of the Board, subject to the order of the Secretary. Under this system, a small balance was maintained in the hands of your Treasurer, and small accounts against the Board could be paid at any time.

One of the amendments which the Common Council proposed to make to the ordinance provided that no accounts should be paid by the Board until they had been approved by the Common Council, and making the City Treasurer treasurer of the Board.

This amendment was modified to the extent of permitting the Board to audit their own accounts, but required them to file a list of the claims with the City Recorder, instead of the former estimate, whereupon the Recorder issues a warrant for the amount of such claims, payable to the order of the Secretary of the Board, upon the presentation of which warrant the City Treasurer transfers the amount mentioned therein to the credit of the Board, subject to the order of the Secretary.

This system has worked satisfactorily, the only objection to it being that persons having small accounts against the Board are obliged to wait until the close of the month on which their claims are presented before receiving their pay.

The amendments took effect early in March, but from the 7th of February, when the Common Council commenced amending the ordinance, there was so much confusion as to the proper manner of paying claims, and the final result so uncertain, that many of the February bills were not paid until March. Mr. Orrin Bump, who had acted as Treasurer of the Board about nine years, served as such until February 12th, when the balance in his hands was transferred to the water works fund.

The balance in the hands of the Treasurer of the Board January 1st, 1887, was	$ 479 81
Amount withdrawn from water works fund by requisition No. 215 on the Recorder, and deposited with Orrin Bump, Treasurer, January 29th, 1887	1,250 00
	$1,729 81
Orders paid by Orrin Bump, Treasurer, between January 1st and February 12th	1,232 25
Balance transferred from Orrin Bump, Treasurer, to city water works fund, February 12th, 1887	$ 497 56

Amount withdrawn from city water works fund, and deposited with the City Treasurer, acting as Treasurer of the Board, as per statements filed with the City Recorder:

February 28th, statement No. 1, pay roll for February		$ 580 00		
March 2d, " " 2		906 34		
March 31st, " " 3		817 04		
April 28th, " " 4		876 39		
May 30th, " " 5		1,471 29		
June 29th, " " 6		1,215 74		
July 29th, " " 7		1,889 43		
August 31st, " " 8		1,725 99		
September 30th, " " 9		817 16		
October 31st, " " 10		1,647 70		
November 30th, " " 11		1,240 47		
December 31st, " " 12		903 45		
				$14,091 00
Orders drawn on the City Treasurer in payment of claims as per statements Nos. 1 to 12, inclusive				14,091 00

Account with water works fund—

Balance in fund January 1st, 1887	$ 305 20		
Amount transferred from Orrin Bump, Treasurer	497 56		
Cash collections deposited with City Treasurer, to be credited to water works fund	19,954 10		
			20,756 86
Amount withdrawn by requisition No. 215 on City Recorder	$ 1,250 00		
Amount transferred by City Treasurer, as per statements Nos. 1 to 12, inclusive	14,091 00		
			15,341 00
Balance in water works fund December 31st, 1887			$5,415 86

The following balance sheets show balance of each account for the year 1887; also, balance of each account since the commencement of the construction of the works:

Ledger Balances for 1887.

	Ledger D.	Debit.	Credit
Folio	1, Office department salaries	$ 2,412 50	
"	2, " " expenses	365 67	
"	3, Street and service department, repairs main distribution	668 44	
"	4, " " " " on services and shut-offs	279 14	
"	5, " " " " and care of meters	196 58	
"	6, " " " " on inlet works	420 07	
"	9, Pumping department, salaries	3,480 00	
"	10, " " fuel	2,087 97	
"	11, " " oil, packing and supplies	318 29	
"	12, " " repairs on machinery	470 20	
"	13, " " " " arches	264 32	
"	22, Interest account	730 00	
"	15, Water meter account	450 90	
"	18, Main distribution, Wyckoff pipe	1,988 92	
"	18, " " iron pipe and branch castings	52 38	
"	16, " " valves	195 92	
"	16, " " fire hydrants	394 50	
"	17, " " laying pipe	415 81	
"	21, Furniture and fixtures	114 01	

Folio 21, Furniture and fixtures, vault	$ 41 52		
" 29, City water works fund	5,110 66		
" 7, Repairs to engine house		$	15 00
" 14, Service connections			147 39
" 20, Engine foundations			54 87
" 37, Water rates roll of 1882			1 00
" 36, " " " 1883			3 00
" 36, " " " 1884			1 00
" 36, " " " 1885			8 87
" 35, " " " 1886			67 80
" 34, " " " 1887			19,299 56
" 38, Plumbers' licenses			50 00
" 38, Rent, dockage, etc			200 00
" 29, Orrin Bump, Treasurer of Board			479 81
	$ 20,327 80	$	20,327 80

Balance of all accounts from commencement of construction of works to December 31st, 1887:

Ledger D.	Debit.	Credit
Folio 401, Office expenses and salaries	$ 30,706 56	
" 491, Repairs and care of hydrants, valves and pipes	9,012 06	
" 402, " " " water meters	621 25	
" 402, " " " reservoir and inlet works	7,456 89	
" 403, " to engine house	1,188 13	
" 403, " to dock	13 38	
" 404, Engineers' and firemen's wages	52,472 84	
" 404, Fuel	42,262 58	
" 405, Oil, packing and supplies	6,270 39	
" 405, Repairs to pumping machinery	4,543 12	
" 406, " to engine foundations	51 46	
" 406, " to boiler arches	923 40	
" 407, Implements and tool repair account	1,129 37	
" 407, Interest account	720 00	
" 408, Water works fund	5,415 86	
" 409, A. L. Stewart	15 00	
" 409, Thomas Rosa estate	15 57	
" 418, Real estate	6,724 83	
" 418, Dock, tramway and store shed	1,882 68	
" 419, Engine house, chimney and wells	19,097 42	
" 419, Engine foundations, boiler foundations and arches	5,881 87	
" 420, Pumping machinery	57,673 05	
" 420, Inlet from Saginaw river	3,218 99	
" 421, Inlet from Saginaw bay	84,778 37	
" 421, Reservoir, breakwaters and filter	24,713 78	
" 422, Iron pipe and branch castings	59,598 86	
" 422, Wyckoff patent pipe	85,177 10	
" 423, Valves for street mains	9,968 58	
" 423, Public fire hydrants	8,871 09	
" 424, Laying pipe	36,883 13	
" 424, Buildings at bay shore	452 46	
" 425, Water meters	10,453 06	
" 426, Furniture and fixtures	802 46	
" 426, Implements used on construction	1,713 61	
" 426, Engineering and general superintendence construction	7,856 17	
" 427, Traveling expenses on construction	306 29	

Folio 427,	Insurance expenses on construction	$ 29 00	
" 428,	Interest, discounts and commission on construction	4,294 17	
" 410,	Water rates roll of 1872-3 to 1880		$ 74,460 71
" 410,	" " " 1881		14,986 61
" 411,	" " " 1882		17,334 27
" 411,	" " " 1883		18,712 13
" 412,	" " " 1884		18,888 25
" 412,	" " " 1885		19,719 00
" 413,	" " " 1886		19,292 42
" 413,	" " " 1887		19,259 36
" 415,	Plumbers' licenses		397 70
" 415,	Rents, dockage, etc		1,387 25
" 416,	Service taps and stop boxes		1,995 82
" 416,	Bills payable		18,000 00
" 417,	Bay City bond account, $377,000 bonds		368,045 57
" 417,	Water assessment (frontage on pipe)		736 05
		$593,126 78	$593,126 78

Total amount of interest on bonds issued for water works purposes from date of first issue, October 1st, 1871, to December 31st, 1887, $431,680, all of which has been paid by the City Treasurer, so far as the coupons have been presented, from moneys collected by tax levy.

The water works department is properly chargeable with this interest account, but should receive credit for rent of fire hydrants, use of water for drinking fountains, hose houses, electric light works, etc.

WATER WORKS BONDS OUTSTANDING DECEMBER 31ST, 1887.

Series.	Date of Issue.	Payable.	Amount.	Interest.
No. 2	January 15, 1872	October 15, 1888	$ 10,000 00	8 per cent.
3	" 15, 1872	" 15, 1889	10,000 00	"
4	" 15, 1872	" 15, 1890	10,000 00	"
5	" 15, 1872	" 15, 1891	10,000 00	"
6	" 15, 1872	" 15, 1892	10,000 00	"
7	" 15, 1872	" 15, 1893	10,000 00	"
8	" 15, 1872	" 15, 1894	10,000 00	"
28	October 15, 1874	" 15, 1894	10,000 00	"
9	January 15, 1872	" 15, 1895	10,000 00	"
29	October 15, 1874	" 15, 1895	10,000 00	"
10	January 15, 1872	" 15, 1896	10,000 00	"
30	October 15, 1874	" 15, 1896	10,000 00	"
11	January 15, 1872	" 15, 1897	10,000 00	"
31	October 15, 1874	" 15, 1897	10,000 00	"
12	January 15, 1872	" 15, 1898	8,000 00	"
32	October 15, 1874	" 15, 1898	10,000 00	"
13	August 15, 1872	February 16, 1899	10,000 00	"
14	" 15, 1872	" 16, 1900	10,000 00	"
33	March 1, 1875	March 1, 1900	10,000 00	"
15	August 15, 1872	February 16, 1901	10,000 00	"
34	March 1, 1875	March 1, 1901	10,000 00	"
6	August 15, 1872	February 16, 1902	10,000 00	"
35	June 1, 1875	June 1, 1902	10,000 00	"
17	August 15, 1872	February 16, 1903	10,000 00	"
36	June 1, 1875	June 1, 1903	10,000 00	"
18	August 15, 1872	February 16, 1904	9,000 00	"
37	June 1, 1875	June 1, 1904	10,000 00	"
19	August 15, 1873	February 16, 1905	10,000 00	"
20	" 15, 1873	" 16, 1906	10,000 00	"
21	" 15, 1873	" 16, 1907	10,000 00	"
22	" 15, 1873	" 16, 1908	10,000 00	"
23	" 15, 1873	" 16, 1909	10,000 00	"
24	February 15, 1874	" 15, 1910	10,000 00	"
25	April 15, 1874	April 15, 1911	10,000 00	"
26	" 15, 1874	" 15, 1912	10,000 00	"
27	" 15, 1874	" 15, 1913	20,000 00	"
			$367,000 00	

Special time orders issued to Holly Manufacturing Company, in payment for pumping engines:

Order.	Date of Issue.	Payable.	Amount.	Interest.
No. 1.....	November 1st, 1886.....	November 1st, 1889.....	$ 4,500 00	4 per cent.
No. 2.....	" 1st, 1886.....	" 1st, 1890.....	4,500 00	"
No. 3.....	" 1st, 1886.....	" 1st, 1891.....	4,500 00	"
No. 4.....	" 1st, 1886.....	" 1st, 1892.....	4,500 00	"
			$18,000 00	

The bonds paid by the City Treasurer and retired were Series No. 1, issued October 1st, 1871, payable October 2d, 1887, amount $10,000, on which 8 per cent. interest has been paid since date of issue.

Source and Supply.

The supply has been taken from Saginaw bay during the entire year, except 21½ hours, when the capacity of the inlet pipe was not sufficient to supply the demand, and the pipe leading from the river was opened enough to supply the deficiency. The occasions on which this has been necessary have been as follows:

February 2d—fire in Bridge block	1 hour	45 minutes
March 12th—fire at Wm. Peters' mill	4 hours	
July 16th—fire in Astor House block		40 "
July 27th—fire in Miller & Lewis' slabs	2 "	15 "
August 2d—fire in R. M. Bradley's box factory		10 "
October 5th—Firemen's display		20 "
October 6th—Firemen's display		20 "
October 23d—low water	8 "	
November 27th—fire in Whitney's cracker factory	4 "	
	21 hours	30 minutes

At no time has the supply been drawn entirely from the river, the nearest approach to it being on the 23d of October, when, during the prevalence of an extreme southwesterly wind, the water in the bay receded to such an extent that it did not enter the reservoir for several hours, and was drawn as low in the reservoir as the inlet pipe would take it.

The average level of the water in Lake Huron has been lower than ever before since the water works were built, in consequence of which it has been necessary to call upon the river supply for assistance upon a lighter demand than ever before.

The supply has been shut off from the bay several times during the year for the purpose of removing accumulations from the strainer at the outer end of the inlet pipe, and on the 28th of

November it was cut off for a short time by an accumulation of anchor ice at the same point, but in each of these cases the supply was renewed before the water in the pipe between the bay and the pumping station was exhausted, and the river supply was not opened.

The water has been quite as free from sediment as usual, except about two months in the spring, when the freshets incident to that season of the year affected the water in the bay more seriously and for a greater length of time than heretofore. Examinations made for a considerable distance into the bay failed to discover any point where the difficulity could be entirely overcome, or, for any considerable portion of the time, very much improved. A part of the time, when the water in the bay was in its worst condition, the supply furnished to the city was better than could have been drawn direct from out in the bay within some miles of the shore, the inlet cut and reservoir forming a settling basin in which enough of the sediment was deposited to make a noticeable difference in the clearness of the water.

The question as to the best means to be adopted to improve the quality of the supply, is now the most important one for the Board to consider.

No chemical analysis has been made of the supply since 1885, when a very complete series of tests were made at the request of the Board by Professor Prescott, of Ann Arbor, the result of which was published in full in the Water Works Report for that year.

The result of these analyses may be briefly summarized as showing: First, That the water in the river is not suitable for domestic use; Second, That the water supplied to the city is much better than river water, but not as good as can be procured from the bay; Third, That, if the water can be procured from any point in the bay where the blue outside waters predominate over the brown shore waters, the quality will compare favorably with the supply furnished any of the cities taking their water from the great lakes.

From the knowledge of facts thus gained, future investigation became simply a matter of inspection, as the most careless observer could hardly fail to detect the difference between the two waters. There is usually a well marked and distinct line between them, although during the spring freshets, and sometimes during, or soon after, a severe storm, it becomes less distinct, and is sometimes difficult todistinguish.

From investigations made since this knowledge was obtained, it ppears that there will be no very marked difference in the quality of he supply whether it be taken from a point about 6,000 feet beyond he present inlet works, or from about half that distance from the shore f the bay, about midway between the mouth of Kawkawlin river and 'otopoco, with the difference, if any, in favor of the west shore of the ay, and a certainty in its favor of a considerable advantage to be ained by an increased depth of water to be procured by an extension f about 3,000 feet more, which could not be reached opposite the pres-nt location of the works short of some miles.

As the consumption of water increases, the river will be called upon help out the supply to a greater extent, and it is a question of but a ery few years when it will be necessary to increase the supply from e bay by laying another pipe.

With this fact in view, it is a mattter for careful consideration hether it is advisable to expend any considerable amount in extend-g and improving the present inlet works, or plan for a change of cation of the inlet works to the west shore of the bay, and expend ly so much money on the present works as will maintain them in eir present condition until such time as the new inlet is completed to at point.

As the routine work of the department will permit, it is my inten-n to make surveys with a view to an estimate of the probable cost of inlet from the point indicated on the west shore of the bay.

Another plan for improving the quality of the supply has sug-sted itself, and is worthy of consideration; that is, the system of me-anical filtration which has been recently introduced in several cities, ne of them larger than our own, and is said to be working satisfac-ily. The introduction of this system would not obviate the necessity an increase in the supply from the bay, as the river water could not fely be substituted for the bay water, even with filtration. As an xiliary to the improvements suggested in the supply from the bay, d to be used when the waters of the bay are not in suitable condition domestic use, such a system of filtration would be of immense value, d if put in in conjunction with the other improvements suggested, uld render our supply equal in quality to that of any city in this untry.

Should no immediate action be taken towards a change in the location of the inlet works, it will be necessary to renew the masonry of the inlet chamber at the bay, and as the timber work which surrounds a portion of that work has become decayed, as also has that of the dam between the reservoir and inlet cut, it should be renewed in masonry. In any event, the reservoir should be cleaned out and the banks paved, the vegetable growth having been so great in the reservoir last season as to make it almost impossible to keep it cut back within reasonable bounds.

In renewing the dam between the inlet cut and reservoir, the pipe through which the water is admitted to the reservoir should be lowered sufficiently to place it well below the lowest point the water in the bay has yet reached.

Pumping Station.

The Gaskill engines were run 8,708 hours and 49 minutes, having been shut down for packing, filing brasses, etc., 51 hours and 11 minutes. The longest continuous run by these engines was from September 26th to December 20th, 85 days. The Holly quadruplex engines were run 50 hours and 55 minutes, and the high-pressure engine and rotary pumps were run 45 minutes, having been run with the Gaskill engines 29 minutes.

Gallons of water pumped by Gaskill engines.....	821,636,706
Gallons of water pumped by quadruplex engines..	5,480,970
Gallons of water pumped by rotary pump.....	77,333
Total quantity of water pumped.....	827,195,009 gallons.

an increase of 47,433,157 gallons from 1886.

The daily average for the year was 2,266,288 gallons. The greatest quantity of water pumped in one day was 2,850,639 gallons, August 4th, and the least quantity pumped in one day was 1,783,903 gallons, April 17th. 818,214,725 gallons were pumped against an average domestic pressure of 40 lbs. per square inch at the pressure gauge in the pumping station, which is equivalent to a lift of 108 feet from the surface of the water in the wells, and 8,980,284 gallons were pumped against an average fire pressure of 84 3-10 lbs., equivalent to a lift of 214 feet from the surface of the water in the wells.

The average stage of water in the wells has been fully one foot lower than during 1886.

The average lift of all the water pumped was 109 15-100 feet.

The works were run under fire pressure 59 hours and 5 minutes, d the total number of alarms was 99.

The quantity of fuel consumed was 2,267¾ cords of pine slabs and gings, costing, delivered in fire-room, $2,033.35, or an average of a tle less than 90 cents per cord, and 7 tons of soft coal and slack, cost-g, with the expense incurred for bins, etc., to take care of it, $25.57. is coal was burned for the purpose of testing its value as compared th pine slabs, with a view to changing the furnaces and grates to coal rners, if that fuel was found to be more economical. Both lump coal d slack were tried, and while the result was not as favorable to the al as would have been the case if the furnaces and grates had been re suitable for that kind of fuel, the difference was so great in favor the slab fuel that it is not probable that changing the furnaces would ercome this difference, and the changes were not made. The lump al, at $3.50 per net ton delivered at engine house, cost $4.00 per llion gallons pumped; slack coal, at $2.25 per ton, delivered, cost .00 per million gallons; while the average for the year with slab fuel s less than $2.50 per million gallons pumped.

The value of cylinder and lubricating oils, packing, cleaning ma-ial, illuminating oil, etc., used at the pumping station, was $299.98.

Very little repairs have been required on the pumping engines, the ncipal items being for general rupairs to the air pump of the quad-plex engine; changing the indicator pipes on the high pressure cyl-der of the Gaskill engine by increasing their size from ½ inch to 1 h, that they might be used as bleeder pipes to convey live steam to low pressure cylinders in case it becomes necessary to carry heavier ter pressure than could be obtained by running compound with the am pressure to which we are limited, and a few items of paint, var-h, etc., for both the Gaskill and quadruplex engines.

Nearly all of the repairs in this department have been upon the ilers and arches. No. 1 was thoroughly overhauled, a new fire sheet t in and the flues all taken out, cleaned and lengthened. The cost of repairs on this boiler was $393.24. Some slight repairs were made No. 3 boiler. A considerable portion of the feed pipes to the boilers ve been renewed, some of the pipes in use less than a year having sted through. Should these pipes continue to be destroyed so rapidly, will pay to replace them with brass pipes.

The nature of the repairs on No. 1 boiler rendered it necessary to remove the upper portion of the arch in which it is set, and inasmuch as the lower portion of this arch had never been renewed since it was built in 1872, and no considerable repairs had been made on any portion of it since 1880, it was determined to rebuild it from the foundation. The expense of tearing out and rebuilding this arch, including new material used, new cover-plate, side door, bolts, etc., was $257.60.

Slight repairs were also made on the setting of boiler No. 2.

The net cost of running the pumping engines was $6,573.42, as follows:

Cost of fuel used		$ 2,056 22
Wages of engineers and firemen		3,480 00
Cost of oil, waste and other supplies used		299 98
Repairs on machinery and boilers		470 20
Repairs on boiler settings		264 22
		$6,573 42
Cost per million gallons pumped	$7 95	
Cost per million gallons raised 100 feet	7 43	
Cost of fuel per million gallons pumped	2 49	
Cost of fuel per million gallons raised 100 feet	2 33	

The pumping engines are all in good condition, ready for instant and severe service. No. 1 and No. 3 boilers are also in good condition, but No. 2 is not; it barely passed inspection last year, and is not worth repairing. It should be replaced at once by a steel boiler.

The pumping plant consists of:

BOILERS.—Three horizontal return tubular boilers, 16 feet long, 5½ feet diameter of shell, with 105 tubes, 2¾ inches interior diameter, in each boiler; boilers set in separate brick arches. Area of grate surface under No. 1 boiler, 27½ square feet; under No. 2 and No. 3 boilers each, 34 square feet. Heating surface on each boiler (½ shell 138.24 tubes 1,209.51), 1,347 75-100 square feet.

Steam pressure carried, 65 lbs.

ENGINES AND PUMPS.—One Gaskill horizontal compound condensing, crank and fly-wheel pumping engine; maximum capacity, 5,000,000 gallons in 24 hours. One Holly quadruplex compound, condensing, crank, and fly-wheel pumping engine; maximum capacity, 3,000,000 gallons in 24 hours. One horizontal, high-pressure piston engine, driving two No. 10 Holly rotary pumps; maximum capacity, 2,500,000 gallons in 24 hours.

Capacity of Gaskill pumps per revolution	121 gallons.
Capacity of quadruplex pumps per revolution	55 "
Capacity of rotary pumps per revolution	17 "

WATER PUMPED. 1887.

MONTH.	GASKILL ENGINES & PUMPS.			QUADRUPLEX ENGINES.			ROTARIES.			TOTALS.		FIRE RECORD.					
	Hours Run.	Revolutions.	Gallons Pumped.	Hours Run.	Revolutions.	Gallons Pumped.	Hours Run.	Revolutions.	Gallons Pumped.	Gallons Pumped.	Daily Average.	No. Alarms.	Hours Run.	Highest Pressure.	Lowest Pressure.	Average Pressure.	Gallons Pumped.
January	741.25	537,201	65,001,321	2.35	4,555	250,525				65,251,846	2,104,898	9	4.12	80	80	80	426,646
February.....	670.25	478,021	57,840,541	1.35	3,001	165,055				58,005,596	2,071,628	6	3.38	80	80	80	513,645
March.....	732.12	509,678	61,671,038	11.48	21,939	1,206,645				62,877,683	2,028,312	16	13.01	115	70	86	1,837,385
April	713.24	464,084	56,154,164	6.20	11,066	608,630	.16	1,800	30,600	56,793,394	1,893,113	9	4.51	90	80	85	711,964
May.....	744.00	530,109	64,143,189							64,143,189	2,069,135	12	5.01	90	80	81	694,419
June.....	708.28	545,728	66,083,088	11.32	22,295	1,226,225				67,259,313	2,241,977	5	1.32	80	80	80	190,575
July.....	742.55	646,486	78,234,806	1.05	2,569	141,295				78,366,101	2,527,939	9	8.54	110	70	87½	1,673,430
August....	740.35	657,714	79,583,394	3.25	7,607	418,385				80,001,779	2,580,702	7	4.31	100	80	83	756,855
September.....	710.40	595,797	72,091,437	9.20	19,486	1,071,730				73,163,167	2,438,772	9	3.49	80	70	79½	599,313
October.....	744.00	622,879	75,368,359				.29	2,749	46,733	75,415,092	2,432,745	5	2.07	110	80	90	367,988
November	720.00	590,879	71,496,359							71,496,359	2,383,212	9	6.55	90	60	85	1,119,008
December	740.45	611,810	74,029,010	3.15	7,136	392,480				74,421,490	2,400,693	3	.34	80	80	80	89,056
Totals	8708.49	6,790,386	821,636,706	50.55	99,654	5,480,970	.45	4,549	77,333	827,195,009	2,266,288	99	59.05	115	60	84.3	8,980,284



Total quantity of water pumped each year since the works commenced operations:

	Gallons.		Gallons.
1873	142,477,725	1881	944,382,043
1874	294,714,798	1882	775,642,466
1875	416,756,579	1883	773,942,702
1876	518,197,129	1884	831,867,463
1877	588,847,186	1885	836,970,046
1878	530,197,897	1886	779,761,852
1879	672,344,128	1887	827,195,009
1880	827,067,872		

Main Distribution.

The distributing mains have been extended during the year as follows:

A 6-inch Wyckoff main has been laid on the west side of Water street from Sixth to Ninth street, with fire hydrants at the northwest corner of Seventh and Water streets and the northwest corner of Ninth and Water streets. The old 6-inch main on the west side of Water street between Second and Sixth streets has been cut, branches put in, and hydrants set at the following described points: 57 feet south from the south line of Center avenue, 117 feet north from the north line of Fifth avenue, and at the north curb line of Third street. Cost, $810.36.

A 6-inch Wyckoff main has been laid in the alley between Adams and Jefferson streets from Tenth to Twelfth street, and thence on James street to Thirteenth street, with fire hydrants at the south curb line of Eleventh street and the southeast corner of Twelfth and James streets. The old 6-inch main in Thirteenth street was cut and a branch inserted with which this main was connected. Cost, $1,029.01.

A 6-inch Wyckoff main has been laid in Sherman street from Nineteenth to Twenty-second street, with fire hydrants at Twenty-first street and at Twenty-second street. Cost, $696.44.

A 6-inch Wyckoff main has been laid in Twenty-second street from Sherman street to Grant street, with a fire hydrant at Grant street. Cost, $361.47.

All of the fire hydrants put in are Holly's patent double-discharge post hydrants, with 4-inch inlet, those on the west side of Water street being provided with independent slide valves to nozzle openings.

These were put in as an experiment, to determine whether it would be sufficiently to the advantage of the fire department to use that form

f hydrant in future extensions to warrant the additional expense of bout $10 per hydrant.

The 8-inch Wyckoff main in Harrison street was cut at Thirty-fth street and a 4-inch branch casting put in for supplying a service ipe leading to Hitchcock & Bialy's saw mill.

The 6-inch Wyckoff main on the south side of Center avenue was lso cut, and a 6-inch branch casting put in to supply the hydraulic ele-ator in the Phoenix block. The cost of putting in these branches was harged to service connections and paid by the consumers for whose enefit they were put in.

The length of pipe removed for the purpose of inserting branches vas—

	8-in.	6-in.	4-in.	Total.
Vyckoff patent mains	7½ ft.	25 ft.	5 ft.	37½ ft.

Total length of pipe laid during the year:

	8-in.	6-in.	4-in.	Total.
ast iron	4 ft.	20½ ft.	1½ ft.	26 ft.
Vyckoff patent	5 ft.	4,010¼ ft.	67¼ ft.	4,082½ ft.
Total	9 ft.	4,031 ft.	68¾ ft.	4,108¾ ft.

Number of stop valves put in:

	6-in.	4-in.	Total.
alvin's patent	2	9	11
lower's patent		1	1
Total	2	10	12

Number of fire hydrants set:

Holly's patent ... 10

Total length of distributing mains connected with the system:

	20-in.	16-in.	12-in.	10-in.	8-in.	6-in.	4-in.	3-in.	Total.
Cast iron	44	1,467	9,083	8,527¾	1,944¾	1,019¾	785¾		22,871½
Wyckoff patent				14,650½	14,693	61,841¼	20,142	319	111,645¾
Total	44	1,467	9,083	23,178¼	16,637¾	62,860½	20,927¾	319	134,517¼

	Miles.	Feet.
Total length of cast iron mains	4	1,751½
Total length of Wyckoff patent mains	21	765¾
Total mains	25	2,517¼

Total number of valves set and in use in the distributing mains:

	16-in.	12-in.	10-in.	8-in.	6-in.	4-in.	3-in.	Total.
Flower's patent	1	3	11	28	78	176	3	300
Galvin's patent	1	2	4	1	5	45		58
Brown's patent		1			1			2
Total	2	6	15	29	84	221	3	360

The 3-inch valves have been put in by this department, but are on branches at present used for supplying private services, and are not properly a part of the main distributing system.

Whole number of public fire hydrants	190
Holly's patent	128
Gaskill patent	15
Matthew's patent	41
Galvin's patent	5
Brown's patent	1

All of the hydrants are double-discharge post hydrants, with 4-inch inlet.

The whole number of leaks in the main pipes during the year was 32.

Leaks in cast iron mains	1
Leaks in Wyckoff mains	31

The leak in the cast iron main was in a lead joint. Cost of repairs, $3.75.

The several leaks in the Wyckoff mains were as follows: Five were small knot holes, easily repaired with a pine plug; 18 were in joints, and were repaired by caulking with dry pine wedges; one was in an old sleeve jacket—replaced by a new one; one was a shaky pipe, which was taken out and a new section and sleeve put in; and six were pipes which gave away by reason of the bands having become corroded, and were repaired by substituting new sections of pipe and a sleeve in each case. Total cost of repairing leaks in Wyckoff mains, $158.73.

The 10-inch main on Harrison street intersected the grade of the sewer put in in Thirty-second street, and was raised to permit the sewer to pass under it, at a cost of $40.95.

The 6-inch main on the west side of Water street in front of 821 N. Water street was undermined by workmen removing the area wall in front of these premises, and was carried into the area. The cost of replacing this pipe and securing it in position was $15.85.

The 6-inch main on the south side of Center avenue has been raised at two points to permit sewers to enter adjacent premises at the required grade. Cost, $6.37.

Two fire hydrants have been moved to the curb line, where changes and improvements brought them within the limits of the sidewalks, and three have been raised to bring them to the proper grade. Cost, $28.95.

The larger portion of the stop-valves in our distributing mains re put in before manufacturers adopted the plan of placing a uniform ed nut on all sizes of stems, and it has been necessary to use a differ- t sized wrench for each size of valves. All of the valves, except part those between Second and Tenth streets, have been provided with nch square nuts, so that one wrench will fit all sizes of valves. At e same time, cast iron extension valve boxes have been substituted the wooden boxes on all valves located in pavements or permanent lks. Amount expended on this work, $180.96.

All of the fire hydrants set previous to 1887 had hose nozzles with yh patent coupling. Several years ago the city fire department anged their hose couplings from the Feyh patent to standard screw, ce which time it has been necessary for the firemen to carry an inter- diate coupling to connect to hydrants. The hydrants set the past ar have the screw coupling, and threads have been cut on most of ose before in use. When this work is completed it will enable the e department to dispense with the intermediate coupling, to their terial advantage. The amount expended on this work, including st of die for threading nozzles without removing them, was $41.10.

Constant watchfulness is necessary to keep the fire hydrants in rking order during the winter months, especially in those portions of e city where there is no adequate drainage. Twelve hydrants were und frozen during the months of February and March, but their ndition was discovered, and they were placed in serviceable condition fore their use was required by the fire department.

The amount expended for inspection and repairs on frozen and oken hydrants and valves, including cost of new parts purchased to place those broken or worn out, and the necessary tools for the work, as $191.78.

Meters and Services.

The number of meters and motor indicators put in during the year as 33, as follows:

	4-in.	3-in.	2-in.	1½-in	1-in.	¾-in.	⅝-in.	½-in.	Total.
ion Rotary	1	1	..	..	..	..	..	..	2
ion Duplex	.	..	..	..	..	..	8	..	8
own	..	..	..	..	3	1	..	1	5
pire	..	..	..	..	..	3	..	5	8
rthington	..	..	2	1	..	..	4	..	7
rsey	..	..	..	..	..	..	1	..	1
Total meters	1	1	2	1	3	4	13	6	31

Motor indicators 2

Meters taken out:

	4-in.	1½-in	1-in.	¾-in.	⅝-in.	½-in.	Total.
Union Rotary	1	..	..	..	2	..	3
Crown	..	.	1	2	..	1	4
Empire	..	..	1	2	..	3	6
Worthington	..	1	..	..	..	..	1
Hersey	..	..	..	..	1	..	1
Totals	1	1	2	4	3	4	15

Total number of meters and motor indicators connected with the distribution, 193, as follows:

	8-in.	4-in.	3-in.	2-in.	1½-in	1-in.	¾-in.	⅝-in.	½-in.	⅜-in.	Total.
Union Rotary	1	5	19	5	2	2	1	1	.	..	36
Union Duplex	..	..	..	..	..	..	..	10	..	..	10
Crown	..	..	..	..	1	23	30	..	28	1	83
Empire	.	..	..	..	..	3	21	..	23	..	47
Worthington	..	..	..	4	6	..	..	4	.	..	14
Total meters	1	5	19	9	9	28	52	15	51	1	190

Motor indicators 3

The motor indicators are located, one on Amherst organ motor and two on hydraulic elevators.

Ten meters are located on sub-mains, supplying a number of services, put in for testing the quantity of water used by a number of consumers, and aiding in the selection of separate services on which to place meters.

One hundred and eighty are on separate services, and meter rates are charged for the water passing through them.

Twelve of the services supplied through meters are shut off temporarily, and one of the elevator indicators is not in use, the elevator to which it is attached having been shut off from the water supply.

One hundred and nine meters are classed as domestic meters, the water supplied through them being used mainly for domestic purposes, and seventy-one are classed as manufacturing.

Seventy-four meters were taken apart, cleaned, and continued in service. Of these, thirty-three had failed to register, and were found to be choked with pieces of wood, or other extraneous matter, which had caught in the working parts of the meter.

Six meters were removed for not registering properly, two of which were found to have been so seriously injured by frost as to be valueless; two were found broken, or so much worn in some of their parts as to require considerable repair, and two were removed because they failed to register after repeated examinations and cleanings without

scovering the source of the difficulty. These meters were all replaced others.

Nine meters were taken out and not replaced, five of which were moved on account of the use of water having been discontinued on e services to which they were attached, and four were test or trial eters, which it seemed unnecessary to retain longer in service.

All of the meters, except test meters, are read each month, and if ere appears to be any unnecessary waste of water, the consumers are once notified of the fact, that they may have an opportunity to reme- it if they wish.

As hereinbefore noted, the total quantity of water pumped during e year shows an increase over 1886 of more than 47,000,000 gallons. ne quantity supplied through meters, notwithstanding the increase in e number of metered consumers and the addition of a large hydraulic evator, shows a falling off of more than 4,500,000 gallons.

This would indicate that consumers supplied through meters are nding it more economical to keep their pipes and fixtures in order than pay for leakage. It also indicates that the waste of water through nmetered services is continually increasing, and if the consumption is ept within the limits of the capacity of the inlet pipe from the bay for y considerable length of time, it will be necessary to continue ex- nding the meter system.

One hundred meters judiciously placed would save the pumpage hundreds of thousands of gallons of water daily. While it might duce the revenue slightly, this would be much more than compen- ted by the saving in wear and tear and increase in the efficiency of e works, besides the greater advantage of not having to call upon the ver to help out the supply.

The number of new service connections made with the main pipes 74, as follows:

	6-in B	4-in B	1-in.	¾-in.	⅝-in.	½-in.	Total.
ith cast iron mains	..	..	..	1	..	..	1
ith Wyckoff mains	1	3	13	14	22	20	73
Totals	1	3	13	15	22	20	74

Service connections taken out:

	1-in.	¾-in.	⅝-in.	Total.
om Wyckoff mains	2	5	3	10

And one 4-inch branch service, heretofore enumerated as a service connection, has been abandoned as such, and is now used to supply a public fire hydrant.

The whole number of service connections with main pipes is 1,395, as follows:

	8-in B	6-in B	4-in B	3-in B	2-in B	2-in	1¼-in	1-in	¾-in	⅝-in	½-in	⅜-in	Total
With cast iron mains....	..	2	9	..	..	2	6	43	56	32	81	5	236
With Wyckoff mains....	1	3	12	1	1	13	..	140	397	186	405	..	1,159
Totals.....	1	5	21	1	1	15	6	183	453	218	486	5	1,395

Twenty-nine branch services, and 1,366 connections made with corporation cocks. Nine service connections have been abandoned and shut off at the tap in the main, and two heretofore reported shut off and abandoned have been reopened and the service renewed.

Whole number of service connections shut off at the main, 63.

Number open, 1,332.

The number of separate services supplied through these open connections is 1,415, of which 1,133 are open and 282 are closed at the stop-cock at the curb. Of the ten service connections removed from the mains, three were taken out on account of leakage at the connection with the main and seven came out with the section of main pipe in which they were inserted, such main pipe having been removed for the purpose of making repairs or inserting branches. Nine of these service connections were replaced by new ones, without expense to the consumer, and one was not replaced, the use of water through it having been permanently abandoned and the buildings removed from the premises.

Two service pipes have been found leaking under circumstances which bore evidence that the leakage was caused by carelessness or neglect of city employes or contractors, and were repaired without expense to the consumer.

Two hundred and eighty-three services have been shut off during the year by employes of the board, of which 116 were shut off for nonpayment of water rates; 25 on account of their service pipes having been found leaking; 70 by request of consumer; 70, premises found unoccupied, and two on account of the services being abandoned and new services put in, but are not shut off at the main pipe.

Three hundred and twelve services have been opened by employes of the Board.

Appended to this report is submitted a summary of statistics of the ater works of this city, compiled in accordance with the suggestions f the New England Water Works Association; also, statement of ses for which water is supplied at schedule rates, through meters, and r public uses; a copy of the report of the accountant on the examiation of the books of the office for 1886, with a statement of material sed in running the pumping engines and a list of consumers supplied rough meters.

Respectfully submitted,

E. L. DUNBAR,

Superintendent and Secretary.

Bay City, Mich., February 11th, 1888.

REPORT OF ACCOUNTANT ON EXAMINATION OF BOOKS OF 1886.

O THE HONORABLE BOARD OF WATER COMMISSIONERS OF THE CITY OF BAY CITY:

GENTLEMEN—I, the undersigned accountant, employed to audit e books and accounts of the Bay City Water Works for the year 1886, g leave to submit the following report:

I have examined the records, vouchers, accounts and books of the cretary, also the several statements as shown in the Superintendent's inted report,

lio 22, Receipts.
lio 23, Expenditures.
lios 24, 25, 26, 27, 28 and 29, Detailed Expenditures.
Folios 32 and 33, Balances.
Folios 33 and 34, Ledger Balances, 1886.

nd find them all correct.

I have also examined all assessment rolls, and compared the same th stubs of receipts, and found them to agree perfectly with each her, and the daily record of the same.

All of which is respectfully submitted.

[Signed,] DANIEL A. MARSHALL.

Bay City, February 25th, 1887.

Summary of Statistics.

Bay City Water Works, Bay County, Michigan.
Population by census of 1884, 29,415.
Date of construction, 1872.
By whom owned, city.
Source of supply, Saginaw Bay, an arm of Lake Huron.
Mode of supply, direct pumping.

Pumping.

1. Builders of pumping machinery, Holly Manufacturing Co., of Lockport, N. Y.
2. Description of fuel: Pine slabs and edgings. Cost per cord, 80 cents to $1.
3. Fuel consumed for the year: 2,267¾ cords wood; seven tons soft coal, for comparative cost. Fuel consumed equal to soft coal, 1,309,857 lbs.
6. Total pumpage in gallons, 827,195,009.
8. Average dynamic head against which pumps work, 109.15.
9. Number of Gallons pumped per lb. of coal, 631.
10. Duty. $= \frac{827,195,009 \times 8.34 \times 100 \times 109.15}{1,309,857} = 57,487,551.$

Cost of pumping figured on pumping station expenses, $6,573.42.

11. Per million gallons pumped, 7.95.
12. Per million gallons raised one foot high, $0.074.

Cost of pumping figured on total maintenance, including interest paid by city, $41,899.29.

13. Per million gallons pumped, $50.65.
14. Per million gallons raised one foot high, $0.464.

RECEIPTS—DIVISION I.		EXPENDITURES.	
A.—Water rates, domestic	$14,757 21	A. A.—Management and repairs, except interest	$11,019 29
B.—Water rates, manufacturing	4,624 02	B. B.—Interest on bonds paid by tax levy	30,160 00
		Interest on bills payable paid by board	720 00
C.—Net receipts from water	$19,381 23	C. C.—Total maintenance for year	$41,899 29
D.—Miscellaneous, service connections, rents, etc	572 87	Bonds paid	10,000 00
E.—Total	$19,954 10	D. D.—Balance to construction	8,214 81
From public funds –			
J.—Tax levy for interest	$30,160 00		
Tax levy to pay bonds maturing	10,000 00		
K.—Total	$60,114 10		$60,114 10
DIVISION II.			
From fixed rates—			
L.—Domestic	$12,283 15		
M.—Manufacturing	587 72		
N.—Total	$12,870 87		
From meter rates—			
O.—Domestic	$ 2,474 06		
P.—Manufacturing	4,036 30		
Q.—Total	$ 6,510 36		

Construction.

RECEIPTS.		EXPENDITURES.	
R.—From balance of previous years	$ 785 01	F. F.—Extension of mains	$2,977 53
From balance from maintenance	8,214 81	H. H.—Water meters	450 90
		Furniture and fixtures	155 53
		I. I.—Total construction	$3,583 96
		J. J.—Balance	5,415 86
	$ 8,999 82		$8,999 82

W.—Net cost of works to date	$430,361 29	
X.—Bonded debt, city bonds	367,000 00	Interest 8 per cent.
Bills payable	18,000 00	Interest 4 per cent.



CONSUMPTION.

1. Estimated population at date, 33,000.
2. Estimated population on lines of pipe, 16,000.
3. Estimated population supplied, 10,500.
4. Total gallons consumed, 827,195,009.
5. Passed through domestic meters, 25,948,789 gallons, or 3 1-10 per cent.
6. Passed through manufacturing meters, 46,527,230 gallons, or 5 6-10 per cent.
7. Average daily consumption, 2,266,- gallons.
8. Gallons per day to each inhabitant 1.6
9. Gallons per day to each consumer 6.2
10. Gallons per day to each service distribution, 22), 1,701.

DISTRIBUTION.

MAINS.

1. Cast iron and Wyckoff patent.
2. Sizes, from 3-inch to 20-inch.
3. Extended, 4.108¾ feet
4. Abandoned, 37½ feet.
5. Total in use, 25½ miles.
6. Cost of repairs, $26.21 per mile.
7. Leaks per mile, 1¼.
8. Small distribution, less than 4 inches, 319 feet.
9. Hydrants added, 10.
10. Number in use, 190.
11. Stop gates added, 12.
12. Number in use, 360.
13. Small stop gates, less than 4-inch, 3.
14. Number of blow-off gates, 19.
15. Range of pressure at center for day and night, 28 to 33 pounds.

SERVICES.

16. Lead, iron, Wyckoff.
17. Size, ¾-inch to 8-inch.
21. Service taps added, 64.
22. Number in use, 1,332.
25. Meters added, 16.
26. Number in use, 190.
    Domestic, 109.
    Manufacturing, 71.
    Test, 10.
27. Motors and elevators added, 6.
28. Number in use, 8.

erial used during the year 1887 in running pumping engines:

2,267¾ cords of wood	costing	$2,063 35
7 tons coal	"	25 57
139 gallons cylinder oil	"	108 58
5 lbs. tallow	"	30
16 lbs. royal lubricant	"	3 20
½ gallon lard oil	"	38
1 lb. plumbago	"	25
113½ lbs. Goodsell's patent packing	"	17 36
18 lbs. Eureka packing	"	11 48
2¼ lbs. sheet rubber	"	1 29
9¼ lbs. Heston cone packing	"	9 38
3 lbs. square rubber packing	"	1 44
3½ lbs. gaskets for boilers	"	1 75
7½ lbs hemp packing	"	1 88
1 lbs. cotton packing	"	1 60
3 lbs. wicking	"	1 20
7 lbs. valve leathers	"	7 00
Gaskets for water gauge glasses	"	25
4 lbs. red lead	"	40
Tripolene, tripoli and rotten stone	"	1 10
Oxalic acid and concentrated lye	"	1 70
557 lbs. wipers	"	34 82
Emery cloth and turpentine	"	60
Brooms, mop, etc	"	2 42
422 gallons kerosene oil	"	44 03
Chimneys, wicks and matches	"	1 91
32 lbs. British scale eradicator	"	6 40
56 lbs. Eureka boiler compound	"	12 48
90 lbs. soap	"	78
ice	"	13 75
Files, oilers, torches, etc	"	7 69
Sheet brass, copper, fittings, etc	"	4 61
		$2,358 90

erial on hand December 31st, 1887:

5 cords of wood	costing	$ 4 80
22 gallons guarantee cylinder oil	"	22 40
2 lbs. royal lubricant	"	4 40
6 lbs. Goodsell's patent packing	"	12 00
5 lbs. 1-inch square rubber packing	"	2 65
7 lbs. ½-inch square rubber packing	"	2 66
18 lbs. sheet rubber	"	10 44
11½ lbs. Heston cone packing	"	17 25
9½ lbs. hemp packing	"	2 37
5 lbs. cotton packing	"	2 40
4½ lbs. wicking	"	1 80
3 lbs. valve leathers	"	6 00
9 lbs. gaskets for boilers	"	4 50
1 lb. red lead	"	10
7 lbs. tripoli	"	70
9 lbs. rotten stone	"	1 35
½ lb. oxalic acid	"	20
116 lbs. wipers	"	6 38
10-12 dozen brooms	"	2 09

25 gallons kerosene oil	costing	$ 2 63
½ dozen lamp chimneys	"	50
4 dozen lamp wicks	"	21
5 dozen boxes matches	"	60
30 lbs. British scale eradicator	"	6 00
50 lbs. Eureka boiler compound	"	4 00
43 bars soap	"	1 72
1 air pump valve	"	3 20
4½ lbs. sheet brass and copper	"	2 25
		$ 125 60

8 lbs. cement, 6 pump valves and cages, 12 feet 1¼-inch belt, 5 lbs rubber belt, 4 lbs. leather belt, furnished free of charge.

Uses supplied at fixed or schedule rates:

1 Armory.
4 Bakeries.
3 Banks.
7 Barber shops.
2 Bath rooms (public).
1 Bath room (Turkish).
184 Baths (private).
5 Blacksmith shops.
8 Boarding houses.
6 Bottling works.
1 Business college.
24 Business blocks (not classified)
9 Butcher shops.
2 Carriage shops.
5 Churches.
2 Cigar factories.
1 Cooper shop.
1 Cracker factory.
1 Creamery
1 Cigar box factory.
658 Dwellings.
1 Express office.
77 Families in blocks.
1 Gas works.
3 Gas engines
1 Green house.
1 Gun shop.
7 Halls (public).
2 Harness shops.
31 Hotels.
286 Hose for sprinkling lawns.
4 Laundries.
1 Machine shop.
29 Offices.
1 Paint shop.
1 Passenger depot.
5 Photograph galleries.
3 Planing mills.
2 Plumbers' shops.
1 Postoffice.
1 Potash factory.
2 Refrigerators.
8 Restaurants.
2 Rinks (roller).
58 Saloons.
1 Salt crusher.
8 School buildings (public).
1 Slaughter house.
1 Soap factory.
11 Stables (livery).
8 Stables (mill).
138 Stables (private).
1 Stone yard.
88 Stores.
4 Tailor shops.
1 Telegraph office.
1 Telephone exchange.
2 Toboggan slides.
2 Undertakers' shops.
593 Water closets.
48 Water closets in schools.
3 Water motors.
1 Wood yard.

Uses supplied through meters:

32 Baths (private).
2 Bakeries.
1 Barber shop.
1 Bath room (public).
1 Boiler shop.
3 Bottling works.
1 Billiard room.
1 Laundry.
1 Lodging house.
5 Machine shops.
11 Offices.
1 Opera house.
2 Organ motors.
2 Passenger depots

1 Brewery.
10 Business blocks (not classified)
1 Carriage factory.
2 Churches.
1 Coal and wood yard.
1 Court house.
1 County jail.
1 Creamery.
111 Dwellings.
13 Drill houses.
1 Dye works.
1 Elevator.
1 Electric light works.
1 Flouring mill.
1 Gas engine.
1 Green house.
37 Hose for sprinkling lawns.
1 Hospital.
16 Hotels.
1 Pipe works.
6 Planing mills.
2 Printing offices.
1 Restaurant.
2 Railroad round houses.
8 Saloons.
16 Salt works.
13 Saw mills.
2 Stables (hotel).
6 Stables (livery).
7 Stables (mill).
20 Stables (private).
2 Stables (street car).
1 Skating rink.
9 Stores.
1 Wooden ware works.
132 Water closets.
24 Pipes on which hydrants or hose connections are located for fire protection.

Public uses for which no compensation is received:

1 City building occupied by police station and city offices.
1 City building occupied by public library and city offices.
6 City hose and truck houses and stables.
15 Water closets in city buildings.
1 Electric light works.
8 Public water troughs.
2 Ornamental fountains in public square.
7 Hose for sprinkling public parks.
190 Public fire hydrants.

Premises shut off:

1 Bank.
2 Boiler shops.
2 Baths (private).
2 Blacksmith shops.
3 Boarding houses.
4 Business blocks (not classified).
1 Butcher shop.
2 Basements (vacant).
1 Cemetery.
1 Cooper shop.
116 Dwellings.
5 Drill houses.
2 Elevators.
1 Gun shop.
23 Hose for sprinkling lawns.
5 Hotels.
7 Hydrants for fire protection.
1 Kindling factory.
1 Market garden.
2 Offices.
1 Planing mill.
2 Pasture lots.
1 Reel factory.
1 Rink (roller).
8 Saloons.
3 Shops.
2 Salt blocks.
3 Saw mills.
7 Stables.
23 Stores.
1 Slaughter house.
8 Water closets.
44 Vacant lots.

List of consumers supplied through meters December 31, 1887:

Domestic Meters.

Name of consumer.	Use.	Kind and size.	Cost.
A. Bence	Hotel	Crown ½-inch	$
Louis Cormier	Hotel	Crown ½-inch	
Louis Cormier	Bottling works	Duplex ⅝-inch	
Mrs. Seymour	Dwelling	Empire ½-inch	
Sandy Anderson	Hotel	Empire ½-inch	
Michigan Central R. R. Co	Passenger depot	Crown ¾-inch	
F. Hamme & Co	Bakery	Empire ½-inch	
John Wald	Dwelling	Empire ½-inch	
E. Eickemeyer	Block	Crown ¾-inch	
Potter & Gregory	Saloon	Rotary ⅝-inch	
C. A. Jay	Hotel	Crown ¾-inch	
C. A. Jay	Hotel	Crown 1-inch	
C. A. Jay	Hotel	Crown ¾-inch	
C. A. Jay	Hotel	Crown ⅝-inch	
Bectel & Son	Hotel	Crown ¾-inch	
E. E. Burroughs	Livery	Crown 1-inch	
L. H. Griffin	Block	Crown ¾-inch	
Henry Birney	Livery	Crown ¾-inch	
Geo. H. Schindehette	Hotel	Crown ¾-inch	
Peter La France	Livery	Crown ¾-inch	
Hurley Bros	Block	Empire ½-inch	
Geo. Cooke	Hotel	Crown 1-inch	
Robert J. Parker	Hotel	Crown ½-inch	
H. Tupper	Barn	Crown ½-inch	
H. Tupper	Dwelling	Crown ¾-inch	
W. P. Root	Hotel	Crown ¾-inch	
F & P. M. R. R. Co	Passenger depot	Crown ¾-inch	
Dr. Evans	Dwelling	Empire ½-inch	
Mrs. J. Ramsdell	Dwelling	Empire ¾-inch	
Mrs. H. S. Benson	Block	Crown ¾-inch	
Mrs. H. S. Benson	Block	Crown ½-inch	
Hurley Bros	Block	Empire ½-inch	
A. H. Dey	Block	Crown ½-inch	
Mrs. C. B. Cottrell	Block	Empire ½-inch	
Young Bros	Office	Empire ¾-inch	
J. F. Antisdel	Hotel	Crown 1-inch	
J. F. Antisdel	Hotel	Empire 1-inch	
J. F. Antisdel	Hotel	Rotary ¾-inch	
A. N. Rouech	Hotel	Crown 1-inch	
A. N. Rouech	Hotel	Empire ¾-inch	
J. E. Bassingthwaite & Co	Livery	Crown ½-inch	
Palace Stable	Livery	Crown ¾-inch	
Bay County Milk Association	Creamery	Empire ½-inch	
Bay City Building Company	Block	Crown 1-inch	
Bay City Building Company	Block	Crown 1-inch	
Phillippi & Foote	Barber shop	Duplex ⅝-inch	
C. M. Averell	Block	Crown ¾-inch	
Wood's Opera House Company	Block	Crown 1-inch	
F. E. Bradley	Dwelling	Empire ¾-inch	
Peter Kelsen	Hotel	Crown ½-inch	
John McDermott	Block	Empire ½-inch	
Wm. Fox	Hotel	Empire ¾-inch	

D. Sherman	Livery	Empire ¾-inch	23 25
j. Conklin	County jail	Crown ¾-inch	32 40
County	Court House	Crown 1-inch	52 64
Erwin	Dwelling	Empire ¾-inch	25 27
Annie F. McEwan	Dwelling	Empire ¾-inch	20 72
Annie F. McEwan	Barn	Crown ½-inch	19 77
. Tyler	Dwelling	Empire ½-inch	18 50
. Tyler	Barn	Worthington ⅝-inch	15 42
es B. Shearer	Dwelling	Crown ½-inch	25 02
. Warren	Dwelling	Crown ¾-inch	35 42
. Webster	Dwelling	Crown ½-inch	17 97
. McGraw	Dwelling	Empire ¾-inch	26 75
Young	Dwelling	Crown ¾-inch	29 75
. Westover	Dwelling	Empire ¾-inch	23 56
copal Society	Church	Crown ½-inch	14 87
n Drake	Dwelling	Duplex ⅝-inch	19 44
. Shearer	Dwelling	Crown ½-inch	25 69
. Watrous	Dwelling	Duplex ⅝-inch	18 04
. Watrous	Barn	Worthington ⅝-inch	19 52
. Knopfel	Dwelling	Crown ½-inch	16 57
. Brotherton	Dwelling	Crown ½-inch	14 61
s. A. Eddy	Dwelling	Crown ¾-inch	29 35
s. H. Bradley	Dwelling	Empire ¾-inch	32 45
unham	Dwelling	Empire ¾-inch	26 32
. Whitney	Dwelling	Crown ½-inch	17 00
. Westover	Dwelling	Empire ¾-inch	22 00
. Mason	Dwelling	Crown ½-inch	14 87
E. Whitney	Dwelling	Duplex ⅝-inch	20 16
l. A. Lewis	Dwelling	Duplex ⅝-inch	23 31
l. W. Bradley	Dwelling	Empire ½-inch	14 90
n McEwan	Dwelling	Crown ½-inch	17 38
D. Clift	Dwelling	Duplex ⅝-inch	17 97
Griswold	Dwelling	Crown ½-inch	14 47
. Warren	Dwelling	Worthington ⅝-inch	13 92
l. C. Loranger	Dwelling	Empire ½-inch	13 75
E. Teall	Dwelling	Empire ½-inch	14 25
es McKeon	Dwelling	Empire ½-inch	15 88
City Street Railway Company	Barn	Empire ¾-inch	26 00
n Bump	Dwelling	Empire ½-inch	14 00
. E. Weadock	Dwelling	Duplex ⅝-inch	17 87
s. Breitmeyer	Greenhouse	Crown ¾-inch	28 70
Hine	Dwelling	Empire ½-inch	19 50
n. S. M. Green	Dwelling	Empire ¾-inch	26 59
n Thompson	Dwelling	Crown ½-inch	19 41
H. Thomas	Dwelling	Worthington ⅝-inch	18 36
. Rose	Dwelling	Empire ½-inch	15 50
Hosher, jr	Dwelling	Duplex ⅝-inch	19 53
n. S. T. Holmes	Barn, etc	Worthington 1½-inch	56 53
Clements & Son	Office	Rotary 1-inch	27 25
Stenger	Bakery	Empire ½-inch	18 90
Atkinson	Dwelling, etc	Empire ½-inch	19 05
es Birney	Dwelling	Empire ½-inch	15 70
thwestern Hospital Company.	Hospital	Empire ¾-inch	24 15
s. Shiler	Bottling works	Empire ¾-inch	25 00
. Hime	Hotel	Empire ½-inch	17 50
R. Fancher & Co	Hotel	Crown 1-inch	42 43
City Street Railway Company	Barn	Crown 1-inch	45 02



SEVENTEENTH ANNUAL REPORT

OF THE

SUPERINTENDENT OF WATER WORKS

BAY CITY, ⁘ MICHIGAN.

FOR 1888.

Tribune Book and Job Rooms.

LIBRARY

OF THE

Boston Society of Civil Engineers.

No. 3959

Received July, 1899.

PRESENTED BY

RULES.

Books and periodicals may be used in the Reading-Room by members and friends, and by students recommended by the Boston Public Library.

Members may borrow books for home use, but no one shall have more than four books at any time, nor keep any book more than five weeks.

A member borrowing a book shall give a receipt therefor to a member of the Library Committee, to the Secretary, or to the regular attendant.

A fine of one cent per day per volume shall be charged for overtime, and must be paid before the delinquent can take any more books.

Current numbers or unbound files of periodicals shall not be taken from the room.

Books of unusual value are marked with a star (*), and must not be taken from the room, except by written permission from the Board of Government.

Any person mutilating or losing a book shall pay for the damage, or replace the book.

Any one who violates the above rules shall, upon written request from the Librarian to the Board of Government, be debarred from the privileges of the library for such time, not less than three months, as the Board of Government may determine.

(Adopted Nov. 18, 1896.)

SECTION. DIVISION. BOOK.
3 -1581- 9.

SEVENTEENTH ANNUAL REPORT

OF THE

SUPERINTENDENT OF WATER WORKS

BAY CITY, ⁘ MICHIGAN.

FOR 1888.

CITY OF BAY CITY, MICHIGAN.

Water Department.

1888.

COMMISSIONERS.

ANDREW WALTON, President.
(Term expires Sept. 6th, 1894.)

G. HENRY SHEARER
(Term expires Sept. 6th, 1895.)

BENJAMIN F. RAY.
(Term expires Sept. 6th, 1889.)

JOHN D. McKINNON.
(Term expires Sept. 6th, 1890.)

LOUIS MORITZ.
(Term expires Sept. 6th, 1891.)

DUNCAN McGREGOR,
(Term expires August 4th, 1889.)

GEORGE C. MYERS,
(Term expires August 4th, 1890.)

Superintendent and Secretary, E. L. DUNBAR.

Office Assistant, T. A DELZELL.

Inspector, FRANK H. COLLINS.

Reservoir Keeper, LEVI D. CARPENTER.

PUMPING DEPARTMENT.

First Engineer.....A. B. VERITY.

Second Engineer.....FRED H. HOLLY.

Fireman.....A. J. CARPENTER.

Fireman.....PATRICK O'HARE.

Superintendent's Report.

To the Honorable Board of Water Commissioners of Bay City, Michigan:

Gentlemen—I have the honor to submit the seventeenth annual report of this department, the same being for the year ending December 31st, 1888.

There have been no changes in the membership of the Board during the year. The term of office of Commissioner G. Henry Shearer expired September 6th, 1888, but at a session of the Common Council held September 24th, 1888, Mr. Shearer was reappointed.

In compliance with the requirements of Section 153 of the City Charter, at the first meeting of the Board after the appointment of Commissioner Shearer, held September 25th, Commissioner Andrew Walton was reappointed President of the Board and E. L. Dunbar was reappointed Secretary.

Under the present Charter the term of office of Commissioner Duncan McGregor will expire August 4th, and that of Commissioner B. F. Ray September 6th of the present year. Commissioner George C. Myers' term will expire August 4th, 1890, and Commissioner J. D. McKinnon's September 6th of the same year.

No vacancy will occur by limitation during the years 1892 and 1893.

The attention of the committee of the Common Council now engaged in revising the City Charter has been called to these facts, and the suggestion made that the term of office of Commissioners McGregor and Myers be extended to September 6th, 1892 and 1893, respectively.

Office.

On the first of January, 1888, the office of the Board was remov from the city building to the present location under the Public Libra this was done by order of the City Council, as embraced in a resolut adopted by that body December 12th, 1887. The rooms to which Board removed had been arranged for Mayor's office and commit rooms, and no suitable arrangement had been made for the protect of valuable papers and books by the construction of a fire proof va As the rooms were tenanted by the city under a 10-year lease, wh had been executed and the rooms accepted by the committee of Common Council, no demand could be made upon the owners of building for the construction of a vault; but under an agreem entered into between the Board of Water Works and Woods' Op House Company, the city was granted the privilege of constructin vault at a cost not to exceed two hundred and fifty dollars—the Op House Company to take it at the expiration of the lease at an apprai value, provided such appraisal shall not exceed one-half of the origi cost.

The estimated cost of the vault was $250.00, but owing to chan in the plan, rendered necessary by obstructions encountered w excavation was made for the foundation, the cost was increased $270.96, not including the shelving and pigeon-holes; including shelving and inside finish as it is at present, the cost was $296.32.

The present office is much better suited to the needs of the dep ment than the one formerly occupied by the Board in the city buildi and with suitable arrangement for heating would be very satisfact to its occupants. If changes cannot be made in the present systen bring the heating pipes near the floor, a separate system should be in for the basement and hot water used instead of steam.

Under the present arrangement with the Board of Trustees of Public Library, by which the Board of Water Works pay one-thir the expense of operating the heating plant, the cost of heating office is nearly or quite three times as much as in the old office, while it cannot be expected to warm the present rooms as cheaply the old office, the cost by the present method is certainly more than should be, to both the Library and the Water Office.

Financial.

Receipts.

The cash receipts of the department during the year have been $21,861.93, an increase of $1,907.83 over the year 1887; this increase has been entirely in receipts from water rates, and largely from new consumers supplied through meters; the increase in amount received for metered water being nearly $1,600.00.

The total amount charged for water on the roll of 1888 was

For water supplied at fixed or schedule rates	$13,169 60	
For water supplied at meter rates	8,170 74	
For water supplied for building purposes	54 45	
		$21,394 79

Total amount collected on roll of 1888—

From fixed or schedule rates	$13,027 24	
From meter rates	8,103 27	
From building purposes	21 85	
		$21,152 36

Amount uncollected on roll of 1888—

From fixed or schedule rates	$ 142 36	
From meter rates	67 47	
From building purposes	32 60	
		$242 43

The average price charged for water supplied through meters during the year was about 8¾ cents per 1,000 gallons.

The total cash collections have been from the following accounts:

From water rates roll of 1882	$ 6 40	
" " " " 1886	54 08	
" " " " 1887	119 59	
" " " " 1888	21,152 36	
Total from water rates		$21,332 43
From plumbers' licenses	$ 55 00	
From sale of service connections	249 50	
From repairs on main distribution	10 00	
From rent of boom	200 00	
From sale of building stone	15 00	
	$	529 50
Total cash receipts		$21,861 93

This amount has been deposited with the City Treasurer to be placed to the credit of the Water Works fund, as per receipts on file as follows:

January 31st, 1888	$1,792 49
February 29th, "	980 90
March 31st, "	1,422 80
April 30th, "	2,151 37

May 31st,	1888	1,500 82
June 30th,	"	1,716 03
July 31st,	"	2,441 75
August 31st,	"	1,426 38
September 29th,	"	1,421 63
October 31st,	"	2,844 31
November 30th,	"	1,491 56
December 31st,	"	2,668 89
		$21,861 93

In addition to the above amount $165.00 was transferred f Water Works fund from the general fund January 30th, 1888, un resolution adopted by the Common Council December 19th, allowing that amount to the Water Board for the safe in the adjacent to the office at that time occupied by the Board in th building.

The total receipts of the Board from all sources since its orga tion in 1871 have been as follows:

Received from city, proceeds of $377,000 in city bonds	$365,045 87
Received from city, frontage tax (assessed 1874 only)	736 07
Water rates collected	224,006 41
Net receipts for service connections, rents, etc	4,084 75
Bills payable, time orders issued to Holly Mfg. Co	18,000 00
	$614,873 10

The total amount of water rates collected, with the am remaining uncollected, and total charged on each year's roll sinc works commenced operations, is as follows:

YEAR'S ROLL.	COLLECTED.	UNCOLLECTED.	TOTAL CH
1873—January 1st to April 30th	$ 728 82		$
1873-4—May 1st, 1873, to April 30th, 1874	5,440 80	$ 1 60	5,4
1874-5—May 1st, 1874, to April 30th, 1875	6,908 16	44 85	6,9
1875—May 1st to December 31st	7,269 55	28 46	7,2
1876	9,571 26	82 73	9,6
1877	9,604 26	134 19	9,7
1878	10,078 15	324 71	10,4
1879	11,708 97	136 07	11,8
1880	13,150 74	130 25	13,2
1881	14,986 61	238 40	15,2
1882	17,340 67	180 65	17,5
1883	18,712 13	99 97	18,8
1884	18,888 27	136 39	19,0
1885	19,710 00	277 31	19,9
1886	19,336 51	138 84	19,4
1887	19,419 15	104 10	19,5
1888	21,152 36	242 43	21,3
Totals	$224,006 41	$2,300 95	$226,3

The total amount uncollected on the seventeen rolls is a trifle than one per cent. of the total amount of the rolls.

EXPENDITURES.

The expenditures of the department during the year have been $20,890.68, an increase of $5,567.43 over the year 1887. This increase is entirely in construction accounts, on account of increased extension of the main distribution, the cost of maintenance having been $770.04 less than for the year 1887.

The decrease in the cost of operating the works has been in the pumping department, and consists in a still further reduction in the cost of fuel, and the small amount of repairs which have been necessary in this department.

The expenditures have been for the following general accounts:

For maintenance accounts—		
Office department:		
Salaries	$ 2,520 00	
Expenses	458 75	
		$ 2,978 75
Street and service department:		
Repairs on main distribution	$ 611 99	
Repairs on services and shut-offs	181 02	
Repairs and care of Water Meters	259 11	
Repairs and care of inlet works	420 00	
Service connections	90 61	
		$ 1,562 73
Pumping department:		
Salaries	3,480 00	
Fuel	1,824 00	
Oil, packing and supplies	274 83	
Repairs to pumping machinery	121 44	
		$ 5,700 27
Repairs on building, etc:		
Repairs on engine house and grounds		7 50
Interest account:		
Interest on time orders to Holly Manufacturing Co		720 00
Total for maintenance accounts		$10,969 25
For Construction accounts—		
Main distribution:		
Wykcoff patent pipe	$ 6,244 48	
Iron pipe and branch castings	205 49	
Valves	514 09	
Hydrants	802 00	
Laying pipe	1,249 61	
		$ 9,015 60
Water meter account:		
Meters and setting meters	552 33	
		$ 552 33

Furniture and fixtures:

Office furniture	98 70	
Balance on vault in Library building	254 80	
		$ 353 50
Total for construction accounts		$ 9,921 43
Total expenditures		20,890 68

These expenditures have been reported to the Common Cou each month, as required by Section 157 of the City Charter.

The expenditures by months have been:

January	$ 1,081 94
February	859 27
March	954 22
April	1,084 52
May	886 05
June	2,324 50
July	4,353 23
August	2,509 66
September	967 20
October	3,406 21
November	1,214 84
December	1,309 04
	$20,890 68

Details of expenditures—

Office salaries:

Superintendent and Secretary's salary	$ 1,800 00	
Office assistant	720 00	
		$ 2,520 00

Office expenses:

Postage, stamps and postal cards	60 95	
Blank books, account memoranda, etc	15 10	
Printed blanks, receipts, notices, statements, etc	57 25	
Stationery, ink, pens, pencils, etc	10 55	
Publishing report for 1887 and envelopes for same	51 25	
Accountant examining books of 1887	30 00	
Binding 3 vol. foreign reports	3 00	
Rent of telephone (2)	80 00	
Dials for recording gauge and expressage	3 90	
Repairs on office and office furniture	5 30	
Exchange on drafts, &c	3 57	
Heating office—coal, wood and moving ashes	42 56	
Expense of moving office and fitting up new office	45 16	
Expense of moving tool room and fitting up new room	36 92	
Expense, etc., on survey of pipe line	13 24	
		$ 458 75

Repairs on main distribution:

Repairing leaks in main pipe	115 80
Changing grade and location of pipes and hydrants for pavements, sewers, etc	39 73
Placing nuts on valves and renewing valve boxes	25 33

Nuts for valves and new valve boxes	48 37	
Threading hydrant nozzles	15 00	
Testing, repacking, banking and flushing hydrants and main pipes	148 57	
Repairing broken hydrants and new parts for same	157 51	
Repairing valves and new parts for same	11 08	
Cleaning wells	11 69	
Repairing two service connections	1 88	
Leveling pipe trenches	2 63	
Water level gauges and setting same	12 52	
Tools for street work and repairing tools	21 88	
		$ 611 99

Repairs on services and shut-offs:

Labor, examining services and turning on and shutting off water	$ 172 89	
Repairing one service	4 63	
Removing 4 service connections and replacing 3	3 50	
		$ 181 02

Repairs and care of water meters:

Labor, reading, examining and cleaning meters	179 19	
Packing and protecting meters	12 21	
Repairing and draining boxes	21 14	
Repairs on broken and frozen meters	43 25	
Pipe fittings, pipe and tools	3 32	
		$ 259 11

Repairs and care of inlet works:

Salary of reservoir keeper		420 00

Service connections:

1 dozen ⅝ inch corporation stops	6 48	
4 3-12 dozen ¾ inch corporation stops	36 68	
8-12 dozen ¾ inch corporation stops	8 12	
1-12 " 1 " " "	1 64	
Labor inserting 71 service connections	37 69	
		$ 90 61

Pumping department, salaries:

First engineer's salary	$ 1,200 00	
Second engineer's salary	960 00	
Two firemen, each $660	1,320 00	
		$ 3,480 00

Fuel:

Folsom & Arnold, 2,280 cords wood @ 50c	1,140 00	
James Mahoney, delivering 2,280 cords wood @ 30c	684 00	
		$ 1,824 00

Oil, packing and supplies:

Cylinder oil and lubricants	$ 106 71	
Packing	8 31	
Wipers and cleaning material	33 86	
Kerosene oil, wicks and chimneys	51 48	
Boiler compound	36 25	
Red lead, white lead, plumbago, etc	3 27	
Ice	8 10	
Steam hose and tools	26 85	
		$ 274 83

Repairs on pumping engines:

Repairs on boilers and new grates	41 24	
Repairs on feed and blow-off pipes	54 67	
Plunger for feed pump	4 75	
Sewer for overflow from hot well	20 78	
		$ 121 44

Repairs on engine house and grounds:

Repairs on engine house	2 25	
Cleaning up engine house grounds	5 25	
		$ 7 50

Interest account:

Paid George C. Wolverton interest on $18,000 time orders from Nov. 1st, 1887, to Nov. 1st, 1888	$ 720 00	
		$ 720 00

Wyckoff pipe:

3,797 feet 10 inches of 8-inch Wyckoff pipe	$ 2,643 31	
Four 8-inch Wyckoff sleeves	22,00	
6,331 feet 2 inches 6-inch Wyckoff pipe	3,121 27	
31 feet 5 inches old 6-inch Wyckoff pipe repaired	2 36	
Three 6-inch sleeves	8 45	
1,383 feet 4 inches 4-inch Wyckoff pipe	421 28	
Six 4-inch sleeves	17 28	
Reducers, plugs, &c	8 53	
		$ 6,244 48

Iron pipe and branch castings:

One 8-inch elbow	$ 7 50	
Two 8x8-inch tees	20 89	
Four 8x6-inch crosses	45 75	
One 8x6-inch tee	8 96	
Five 8x4-inch tees	42 97	
One 6x6-inch cross	4 65	
Two 6x6-inch tees	10 35	
Eleven 6x4-inch tees	44 64	
Seven 4x4-inch tees	19 78	
		$ 205 49

Valves for street mains:

Three 8-inch valves	$ 72 00	
Seven 6-inch valves	98 00	
Twenty-seven 4-inch valves	243 00	
Two 3-inch valves	16 00	
Twenty-three iron valve boxes	80 50	
Sixteen wood valve boxes	4 52	
		$ 514 02

Fire hydrants:

Twenty-one Matthews hydrants	$ 630 00	
One " " crane attachment	90 00	
Three Holly hydrants	82 00	
		$ 802 00

Laying pipe:

11,671 feet of trenching @ 9½ cts	$ 1,108 72	
Eight days extra labor on pavement crossings	14 00	
11⅓ days extra labor inserting branches in old pipes	20 11	
9¾ days labor setting 6 hydrants on old lines of pipes	17 06	

5½ days extra labor connecting blow-offs and setting hydrants	9 63	
Tile and clamps for connecting blow-off valves to sewers	8 85	
Inspector's time on surveys and setting hydrants	66 25	
Drayage and repairs on pipe tools and pipe	4 99	
		$ 1,249 61

Water meters:

Two 1-inch Hersey meters and freight	$ 54 98	
Five ¾ " " "	97 00	
Five ¾ Empire " "	101 40	
Ten ⅝ Duplex " "	173 10	
Lumber and nails for meter boxes	27 34	
Plumbers' work setting meters (1887)	6 70	
Plumbers' work and fittings setting meters (1888)	42 98	
Labor setting and boxing meters	48 83	
		$ 552 33

Office furniture:

Safe for vault and freight on same	$ 41 27	
Cabinet for draughting table and plats	45 12	
Picture molding, hooks, cord, etc	4 08	
Curtains for office	6 78	
Inkstands, etc	1 45	
		$ 98 70

Vault in Library building:

Mason work on vault	$ 130 00	
Vault door and freight	86 34	
Steps to vault	10 13	
Moving gas pipe for vault and gravel for vault bottom	2 97	
Pigeon holes and shelving	25 36	
		$ 254 80

In addition to the expenditures of the Board as detailed, the City Treasurer has paid from moneys raised by tax levy the interest on outstanding bonds issued for the construction of water works amounting to $29,360.00; also $9,500 of the $10,000 bonds which matured October 15, 1888. One $500.00 bond (No. 16) of this series (No. 2) has not been presented for payment.

The total expenditures of the board for all purposes since the commencement of the construction of the works has been as follows:

For construction accounts	$440,078 35
For maintenance accounts	168,242 64
	$608,320 99

Account with water works fund and Treasurer of Board:

The balance in water works fund January 1st, 1888, was	$ 5,415 86	
Cash collections deposited by Secretary and placed in that fund by City Treasurer	21,861 93	
Transferred from general fund to water works fund by order Common Council	165 00	
		$27,442 79

Amount withdrawn from fund and deposited with the City Trea
acting as Treasurer of the Board, as per statement of claims
with the City Recorder by the Secretary of the Board:

Statement No.	13	filed	January 30th,	1888	$ 1,081 94
"	14	"	Feb. 29th,	"	859 27
"	15	"	March 30th,	"	954 22
"	16	"	April 30th,	"	1,024 52
"	17	"	May 31st,	"	886 05
"	18	"	June 29th,	"	2,334 50
"	19	"	July 30th,	"	4,353 23
"	20	"	August 30th,	"	2,509 66
"	21	"	Sept. 28th,	"	967 20
"	22	"	Oct. 30th,	"	3,406 21
"	23	"	Nov. 30th,	"	1,214 84
"	24	"	Dec. 31st.	"	1,309 04
					$20,890 68
Balance in water works fund Dec. 31, 1888					6,552 11

Amount deposited with City Treasurer in his capacity as Trea
of the Board, being Recorder's warrants No. 228 to No. 239 incl
$20,890.68.

Amount of orders drawn on Treasurer by the Secretary of B
orders Nos. 249 to 521 inclusive, $20,890.68.

Ledger Balances.

Balance of accounts for 1888:

Ledger D.		Debit.
Folio 71,	Office department salaries	$ 2,520 00
" 76,	" " expenses	458 75
" 83,	Street and service department, repairs on main distribution	617 56
" 74,	" " " " services and shut-offs	181 02
" 75,	" " " " and care water meters	259 11
" 76,	" " " " " inlet works.	420 00
" 78,	Pumping department salaries	3,480 00
" 79,	" " fuel	1,824 00
" 80,	" " oil, packing and supplies	274 83
" 81,	" " repairs on machinery	121 44
" 87,	Interest account	720 00
" 85,	Water meters	352 33
" 86,	Furniture and fixtures, vault	254 80
" 90,	Main distribution, Wyckoff pipe	6,244 48
" 90,	" " iron pipe and branch castings	205 49
" 91,	" " valves	514 02
" 91,	" " hydrants	802 00
" 92,	" " laying pipe	1,264 61
" 99,	City water works fund	1,136 25

Folio 77, Street and service department, service connections		$ 158 89
" 84, Repairs to buildings		7 50
" 86, Furniture and fixtures, office furniture		66 30
" 100, Rents, dockage, etc		200 00
" 101, Water rates roll of 1882		6 40
" 102, " " " 1886		54 08
" 102, " " " 1887		119 59
" 106, " " " 1888		21,152 36
" 107, Plumbers' licenses		55 00
" 108, A. L. Stewart		15 00
" 108, Thos. Rosa estate		15 57
	$21,850 69	$21,850 69

Balance of accounts from January 1st, 1872:

Ledger D.	Debit.	Credit.
Folio 401, Office expenses and salaries	$ 33,685 31	
" 401, Repairs and care of hydrants, valves and pipes	9,810 64	
" 402, Repairs and care of water meters	880 36	
" 402, Repairs and care of reservoir and inlet works	7,878 89	
" 403, Repairs to engine house	1,175 63	
" 403, Repairs to dock	13 38	
" 404, Engineers' and firemens' wages	55,952 84	
" 404, Fuel	44,086 58	
" 405, Oil, packing and supplies	6,545 22	
" 405, Repairs to pumping machinery	4,664 56	
" 406, Repairs to engine foundations	51 46	
" 406, Repairs to boiler arches	928 40	
" 407, Implements and tools, repair account	1,129 37	
" 407, Interest	1,440 00	
" 408, Water works fund	6,552 11	
" 418, Real estate	6,724 83	
" 418, Dock, tramway and store shed	1,882 63	
" 419, Engine house chimney and wells	19,097 42	
" 419, Engine foundations, boiler foundations and arches	5,881 87	
" 420, Pumping machinery	57,673 05	
" 420, Inlet from Saginaw river	3,218 99	
" 421, Inlet from Saginaw bay	84,778 37	
" 421, Reservoir, breakwaters and filter at bay	24,713 78	
" 422, Iron pipe and branch castings	59,804 35	
" 422, Wyckoff patent pipe	91,421 58	
" 423, Valves for street mains	10,482 60	
" 423, Public fire hydrants	9,673 09	
" 424, Laying pipe	38,147 74	
" 424, Buildings at bay	452 46	
" 425, Water meters	11,005 39	
" 425, Furniture and fixtures	990 96	
" 426, Implements on construction	1,713 61	
" 426, Engineering and general superintendence on construction	7,856 17	
" 427, Traveling expenses on construction	206 29	
" 427, Insurance expenses on construction	29 00	
" 428, Interest, discount and commissions on construction	4,224 17	

Folio 410, Water rates, roll from 1872 to 1880	$ 74,460 71
" 410, " " roll of 1881	14,986 61
" 411, " " " 1882	17,340 67
" 411, " " " 1883	18,712 13

Folio 412, " " " 1884		18,88
" 412, " " " 1885		19,71
" 413, " " " 1886		19,32
" 413, " " " 1887		19,41
" 414, " " " 1888		21,13
" 415, Plumbers' licenses		42
" 415, Rents, dockage, etc		1,58
" 416, Service taps and stop boxes		2,06
" 416, Bills payable		18,00
" 417, Bay City bond account		368,04
" 417, Water assessment, frontage on pipe		70
	$614,873 10	$614,87

Water Works Bonds Outstanding December 31st, 1888.

Series.	Date of Issue.	Payable.	Amount.	Interes
No. 2	January 15, 1872	October 15, 1888	$ 500 00	Not pres
" 3	" 15, 1872	" 15, 1889	10,000 00	8 per cen
" 4	" 15, 1872	" 15, 1890	10,000 00	"
" 5	" 15, 1872	" 15, 1891	10,000 00	"
" 6	" 15, 1872	" 15, 1892	10,000 00	"
" 7	" 15, 1872	" 15, 1893	10,000 00	"
" 8	" 15, 1872	" 15, 1894	10,000 00	"
" 28	October 15, 1874	" 15, 1894	10,000 00	"
" 9	January 15, 1872	" 15, 1895	10,000 00	"
" 29	October 15, 1874	" 15, 1895	10,000 00	"
" 10	January 15, 1872	" 15, 1896	10,000 00	"
" 30	October 15, 1874	" 15, 1896	10,000 00	"
" 11	January 15, 1872	" 15, 1897	10,000 00	"
" 31	October 15, 1874	" 15, 1897	10,000 00	"
" 12	January 15, 1872	" 15, 1898	8,000 00	"
" 32	October 15, 1874	" 15, 1898	10,000 00	"
" 13	August 15, 1872	Febr'y 16, 1899	10,000 00	"
" 14	" 15, 1872	" 16, 1900	10,000 00	"
" 33	March 1, 1875	March 1, 1900	10,000 00	"
" 15	August 15, 1872	Febr'y 16, 1901	10,000 00	"
" 34	March 1, 1875	March 1, 1901	10,000 00	"
" 16	August 15, 1872	Febr'y 16, 1902	10,000 00	"
" 35	June 1, 1875	June 1, 1902	10,000 00	"
" 17	August 15, 1872	Febr'y 16, 1903	10,000 00	"
" 36	June 1, 1875	June 1, 1903	10,000 00	"
" 18	August 15, 1872	Febr'y 16, 1904	9,000 00	"
" 37	June 1, 1875	June 1, 1904	10,000 00	"
" 19	August 15, 1873	Febr'y 16, 1905	10,000 00	"
" 20	" 15, 1873	" 16, 1906	10,000 00	"
" 21	" 15, 1873	" 16, 1907	10,000 00	"
" 22	" 15, 1873	" 16, 1908	10,000 00	"
" 23	" 15, 1873	" 16, 1909	10,000 00	"
" 24	Febr'y 15, 1874	" 16, 1910	10,000 00	"
" 25	April 15, 1874	April 15, 1911	10,000 00	"
" 26	" 15, 1874	" 15, 1912	10,000 00	"
" 27	" 15, 1874	" 15, 1913	20,000 00	"
			$357,500 00	

Bond No. 16 of series No. 2 was payable October 15th, 1888, has not been presented; it will draw no interest from date mentioned

Interest bearing orders issued to The Holly Manufacturing C pany, in payment for pumping engines:

Order.	Date of Issue.	When Payable.	Amount.	Inter
No. 1	November 1st, 1886	November 1st, 1889	$ 4,500 00	4 per c
No. 2	" 1st, 1886	" 1st, 1890	4,500 00	"
No. 3	" 1st, 1886	" 1st, 1891	4,500 00	"
No. 4	" 1st, 1886	" 1st, 1892	4,500 00	"
			$18,000 00	

The City Treasurer has paid $9,500 of the principal of the water works bonds, making a total amount of bonds paid $19,500.

Total amount of interest paid on water works bonds since their issue is $461,040.00, less the amount of coupons not presented.

The water works department has paid the interest on the special orders issued to the Holly Company in payment for pumping engines, and will provide for the payment of order No. 1, which falls due during the present year.

Source and Supply.

The quality of the supply has been better than ever before during the summer season. The prevailing winds have been easterly, and the discharge from the river did not bear to the east shore to as much extent as usual; the blue outside waters of the bay have prevailed in the reservoir nearly all of the time since the water cleared from the spring freshets in June.

From the breaking up of the ice in April until the latter part of June the water carried a very large quantity of sediment, and there appeared to be but little difference in this respect for several miles out in the bay.

The water level in the bay has been lower than before, and this combined with the increase in the quantity of water supplied has rendered it necessary to re-enforce the supply by a partial use of the river water to a greater extent than ever before.

The river valve has been opened thirty-two times during the year, as follows:

January	12th,	fire alarm;	open		40	minutes
"	16th	"	"		5	"
"	22	"	"		20	"
"	24	"	"		25	"
Feb'y	13	"	"		15	"
"	14	"	"	1 hour	5	"
"	15	"	"	3 hours	35	"
March	19	"	"		55	"
April	3	"	"		20	"
"	3	"	"	3 hours		
June	12	"	"	1 hour		
"	20	"	"	6 hours	25	minutes
July	2	"	"	1 hour	10	"
"	3	"	"		15	"

"	4	"	"		10	"
"	4	"	"		14	"
"	4 and 5	"	"		55	"
"	5	"	"		5	"
"	6	"	"		38	"
"	16	"	"		40	"
August	1	"	"	1 hour	50	"
"	1	"	"		25	"
"	7	"	"		20	"
Septem'r	5	"	"	3 hours	30	"
"	10	"	"	2 hours	12	"
October	19	"	"		10	"
"	23	"	"		20	"
"	30	"	"		45	"
"	30	"	"		9	"
Nov.	5	"	"	4 hours		
Dec.	20 low water in bay			3 hours	30	"
"	27 "	"	"	5 hours		
Total				44 hours	23 minutes.	

During this time the river supply has been called upon only make up the defficiency in the supply from the bay, the bay pipe bei left open, and the river valve opened only sufficient to maintain water at a safe level in the suction wells.

From present indications the level of the water in the upper la will remain permanently lower than heretofore; this, together with increase in the quantity of water supplied, will necessitate calling u the river to a greater extent each year, unless there is a more exten application of the meter system sufficient to materially reduce quantity of water supplied, or the capacity for supplying water from bay increased.

As stated in the last report of this department, a survey was co menced during the latter portion of the winter of 1887–8 for an i from the west shore of the bay, and lines run as far as the bay shore, on account of the breaking up of the ice in the bay, and the pressure routine work the soundings in the bay have not been taken.

It is hoped that this survey can be completed, and an estim made of the cost of an inlet from that shore during the present winter

The present inlet works are in as good condition as heretof except the ordinary deterioration which is to be expected from material used in their construction.

The stone filled breakwaters are good for several years, but

inlet chamber and timber work between inlet cut and reservoir should be replaced with more durable material and the vegetable accumulations in the reservoir cleaned out.

Pumping Station.

The plant at the pumping station is in good condition. The pumping engines have done their work in a satisfactory manner, supplying all demands readily and easily.

The quadruplex engines and pumps, and the high pressure engine and rotary pumps are in just as good condition as a year ago, and ready for instant service up to their maximum capacity. The steam ends of the Gaskill engines are in first-class condition, showing no deterioration at any point. The pump ends show much wear on the packing gland below the plunger; recent investigation shows that about 10 per cent of the water apparently pumped is passing back and forth by the plungers.

Suitable provision was made in the construction of these pumps for repacking, and changes are now being made in the material used for packing which it is hoped will enable us to overcome this leakage without material expense.

The boilers are in about the same condition as a year ago—No. 1 and No. 3 are in good serviceable condition. The recommendation of last year that No. 2 be replaced by a steel boiler is renewed. It has been necessary to place a small patch in the fire sheet of this boiler near the front head. No repairs have been required in the settings of any of the boilers.

The Gaskill engines have been run 8,743 hours and 3 minutes, having been shut down 40 hours and 57 minutes for filing brasses, packing, etc.

The longest continuous run of these engines was from May 3rd to June 21st—49 days.

The Holly quadruplex engines have been run 41 hours and 7 minutes, having been run with the Gaskills 15 minutes, and the high pressure engine with rotary pumps have been run 15 minutes, 10 minutes with the quadruplex and five minutes for supplying the city alone —neither of the other engines being running.

The total quantity of water pumped into the city, based up pumps delivering their full capacity at each stroke, was 969,3 gallons; but assuming that the slip on the Gaskill pumps was cent., the total quantity pumped was 872,990,164 gallons, an incr 45,795,155 gallons over the previous year.

Pumped by Gaskill engines.....	867,471,155	gallons
Pumped by quadruplex engines.....	5,483,445	"
Pumped by rotary pumps.....	35,564	"
	872,990,164	gallons

861,604,711 gallons were pumped against an average do pressure of 40 lbs. per square inch at the pressure gauge in the p ing station, which is equivalent to a lift of 108 feet from the surf the water in the wells, and 11,385,453 gallons were pumped agai average fire pressure of 82 lbs. per square inch at the gauge, e lent to a lift of 209 feet from the level of the water in the wells.

The average lift of all the water pumped was 109 3-10 feet.

The works were run under fire pressure 68 hours and 43 mi and the number of fire alarms received was 110.

On the first day of January, 1888, there was 1,000 cords o slabs piled on the water works yard, none of which was paid fo agreement with the parties furnishing the wood being that it shou paid for monthly, as consumed.

Under instructions from the Board embraced in a reso adopted April 24th, 1888, a contract was entered into with M Folsom & Arnold for furnishing an additional 2,000 cords of the kind of fuel, to be delivered and piled on the yard at the pum station, to be paid for as before in monthly installments as bu Under this agreement 2,270 cords were delivered during the seas

There remained on the yard at the close of the year 990 making total number of cords delivered in the fire-room durin year 2,280 cords. The cost of this wood delivered in the fire-r 80 cents per cord, making total amount paid for fuel $1,824.00.

The net cost of running the pumping engines was $5,722.44, as follows:

For fuel used	$ 1,824 00	
For engineers' and firemens' wages	3,480 00	
For oil, packing and supplies used	297 30	
For repairs on engines and boilers	121 44	
		$ 5,722 74
Cost per million gallons pumped	$6 55	
Cost per million gallons raised 100 feet	6 00	
Cost of fuel per million gallons pumped	2 09	
Cost of fuel per million gallons raised 100 feet	1 91	

The pumping plant is the same as one year ago.

BOILERS.—Three horizontal return tubular boilers 16 feet long, 5½ feet diameter of shell, with 105 tubes 2¾ inches interior diameter in each boiler, the boilers set in separate brick arches.

Area of grate surface under No. 1 boiler, 27½ square feet; under No. 2 and 3 each, 34 square feet.

Heating surface of each boiler (½ shell 138.24; tubes, 1,209.51) 1,347.75 square feet. Steam pressure carried, 65 lbs.

ENGINES AND PUMPS.—One Gaskill horizontal, compound condensing, crank and fly wheel pumping engine, maximum capacity 5,000,000 gallons in 24 hours.

One Holly quadruplex, compound condensing, crank and fly-wheel pumping engine, maximum capacity 3,000,000 gallons in 24 hours. One horizontal high pressure piston engine, driving through gearing two Holly rotary pumps, size No. 10, maximum capacity 2,500,000 gallons in 24 hours.

Capacity of Gaskill pumps per revolution	121 gallons.
Capacity of quadruplex pumps per revolution	55 "
Capacity of rotary pumps per revolution	17 "

Total quantity of water pumped each year since the works commenced operation:

	Gallons.		Gallons.
1873	142,477,725	1881	944,382,043
1874	294,714,798	1882	775,642,466
1875	416,756,579	1883	773,942,702
1876	518,197,129	1884	831,867,463
1877	538,847,186	1885	836,970,046
1878	530,197,397	1886	779,761,852
1879	672,344,128	1887	827,195,009
1880	827,067,372	1888	872,990,164

WATER PUMPED, 1888.

MONTH.	GASKILL ENGINES.			QUADRUPLEX ENGINES.			ROTARIES.			TOTALS.		FIRE RECORD.					
	Hours Run.	Revolutions.	Gallons Pumped.	Hours Run.	Revolutions.	Gallons Pumped.	Hours Run.	Revolutions.	Gallons Pumped.	Gallons Pumped.	Daily Average.	No. Alarms.	Hours Run.	Highest Pressure.	Lowest Pressure.	Average Pressure.	Gallons Pumped.
January	743.10	648,400	78,456,400	.50	1,653	90,915				78,547,315	2,533,784	7	4 17	100	80	82½	738,221
February.....	690.50	618,697	74,862,337	5.10	12,266	674,630				75,536,967	2,604,723	16	9.50	80	70	80	1,678,512
March.....	741.35	654,733	79,224,693	2.25	5,781	317,955				79,540,648	2,565,827	6	4.38	80	80	80	762,663
April	720.00	614,002	74,294,242							74,294,242	2,476,475	13	7.48	90	80	85½	1,300,024
May.....	734.40	581,159	70,320,239	9.35	21,660	1,191,300				71,511,539	2,306,824	4	1.30	80	80	80	220,704
June	718.15	648,197	78,431,837	1.45	4,564	251,020				78,682,857	2,622,762	9	9.42	80	80	80	1,909,017
July.....	738.43	771,150	93,309,150	5.17	14,057	773,135	.10	1,182	20,094	94,102,379	3,035,561	19	7.21	100	70	84	1,443,120
August	744.00	755,757	91,444,597							91,446,597	2,949,890	8	3.22	80	70	74	689,821
September.....	714.30	679,977	82,277,217	5.30	15,725	864,875				83,142,092	2,771,403	8	8.35	100	70	93	1,709,246
October.....	743.55	667,391	80,754,311				.05	910	15,470	80,769,781	2,605,477	7	2 33	80	80	80	450,846
November	717.45	663,503	80,283,863	2.15	5,508	307,890				80,591,753	2,686,392	7	6.40	80	60	73	1,373,471
December	735.40	662,793	80,197,953	8 20	18,395	1,011,735				81,209,678	2,619,667	6	2 27	80	60	76	374,858
Totals.....			963,856,839							969,375,848	2,648,568						12,650,503
Deduct 10 per cent on Gaskill			96,385,684							96,385,684							1,265,050
Net Total.....	8,743.03	7,965,759	867,471,155	41.07	99,699	5,483,445	.15	2,092	35,564	872,990,164	2,385,219	110	68.43	100	60	82	11,385,453



Main Distribution.

Extensions of the main distribution have been made during the year as follows:

An 8-inch Wyckoff pipe in Lincoln avenue from Second street to Center avenue, with 3 fire hydrants.

A 6-inch Wyckoff pipe in Lincoln avenue from Center avenue to Tenth street, with 4 fire hydrants.

An 8-inch Wyckoff pipe in Tenth street from Lincoln avenue to Sherman street.

An 8-inch Wyckoff pipe in Johnson street from Center avenue to Ninth street, with 4 fire hydrants.

A 4-inch Wyckoff pipe in Ninth street from Johnson street to Trumbull street, with 1 fire hydrant.

A 6-inch Wyckoff pipe in Twenty-second street from Grant street to Madison avenue, with 2 fire hydrants.

An 8-inch Wyckoff pipe in Twenty-second street from Madison avenue to Michigan avenue.

An 8-inch Wyckoff pipe in Michigan avenue from Twenty-second street to Twenty-third street, with 1 fire hydrant.

A 6-inch Wyckoff pipe in Twenty-third street from Michigan avenue to Fitzhugh street.

A 6-inch Wyckoff pipe in Webster street from Fremont avenue to South Center street, with 3 fire hydrants.

A 6-inch Wyckoff pipe in McEwan street from Water street to Campbell street, with 1 fire hydrant.

Fire hydrants have been placed on lines of pipe before laid, as follows:

One on the 4-inch Wyckoff pipe in alley between Jackson and Van Buren street on the north side of Fourth street.

One on the 4-inch Wyckoff pipe in alley between Madison and Monroe street on the north side of Fourth street.

One on the 4-inch Wyckoff pipe in alley between Jackson and VanBuren street, on the north side of Seventh street.

One on the 4-inch Wyckoff pipe in alley between Madison and Monroe street, on the north side of Eighth street.

One on the 4-inch Wyckoff pipe in alley between Adams and Jef ferson street on the north side of Eighth street.

One on the 4-inch Wyckoff pipe in alley between Saginaw an Washington street on the north side of Sixth street.

The cost of these several extensions, including cost of making co nections with lines of pipe before laid, has been as follows:

Lincoln avenue from Second street to Center avenue	$1,372 94
Lincoln avenue from Center avenue to Tenth street	1,336 27
Tenth street from Lincoln avenue to Sherman street	464 37
Johnson street from Center avenue to Ninth street	1,356 02
Ninth street from Johnson street to Trumbull street	521 74
Twenty-second street from Grant street to Madison avenue	785 83
Twenty-second street from Madison avenue to Michigan avenue	204 27
Michigan avenue from Twenty-second street to Twenty-third street	226 48
Twenty-third street from Michigan avenue to Fitzhugh street	362 21
Webster street from Fremont avenue to South Center street	1,731 66
McEwan street from Water street to Campbell street	260 17
Alley between Jackson and VanBuren street at Fourth street	55 87
Alley between Madison and Monroe street at Fourth street	55 78
Alley between Jackson and VanBuren street at Seventh street	56 01
Alley between Madison and Monroe street at Eighth street	58 66
Alley between Adams and Jefferson street at Eighth street	56 86
Alley between Saginaw and Washington street at Sixth street	120 44
	$9,015 60

For the purpose of connecting these several lines of pipe with system before in use, it has been necessary to take out pipe as follows

On the north side of Center avenue at Lincoln avenue, one sect of 8-inch Wyckoff pipe.

On the south side of Center avenue at Lincoln avenue, one sect of 6-inch Wyckoff pipe.

On Johnson street at the south side of Center avenue, one 8-i by 6-inch tee.

On Fremont avenue at Webster street, one section of 8-i Wyckoff pipe.

On South Center street at Webster street, one section of 6-i Wyckoff pipe.

In alley between Jackson and Van Buren street at Fourth st one section of 4-inch Wyckoff pipe.

In alley between Madison and Monroe street at Fourth street, section of 4-inch Wyckoff pipe.

In alley between Jackson and VanBuren street at Seventh street, one section of 4-inch Wyckoff pipe.

In alley between Madison and Monroe street at Eighth street, one section of 4-inch Wyckoff pipe.

In alley between Adams and Jefferson street at Eighth street, one section of 4-inch Wyckoff pipe.

In alley between Saginaw and Washington avenue, at Sixth street, one section of 4-inch Wyckoff pipe.

It has also been necessary to remove four sections of 6-inch Wyckoff pipe on Parker street at the intersection of Atlantic street, to make way for the main brick sewer constructed on Atlantic street.

The total length of pipe taken out was:

	8-inch.	6-inch.	4-inch.	Total.
Cast iron pipe	4½ ft.			4½ ft.
Wyckoff pipe	15¼ ft.	46 ft.	36⅓ ft.	97 10-12 ft.

Length of pipe laid during the year:

	8-inch	6-inch.	4-inch.	Total.
Cast iron pipe	66-10-12 ft.	24 1-12 ft.	10 ft.	100 11-12 ft.
Wyckoff pipe	3,835⅔	6,376 7-12	1,391⅓	11,603 7-12 ft
Total	3,902½	6,400¾	1,401⅓	11,704⅛ feet
			2 miles	1,144⅛ feet.
Net increase			2 miles	1,042 2-12 feet.

Total main pipe in distribution system:

	20-in	16-in	12-inch.	10-inch.	8-inch.	6-inch.	4-inch.	3-inch.	
Cast iron pipe	44	1,467	9,083	8,527¾	2,007 ⅛	1,043⅓	795¾		22,967 11-12
Wyckoff pipe				14,650 ⅛	18513 2-12	68,171 10-12	21,497	319	123,151 ½
Total	44	1,467	9,083	23,178 ¼	20,520 ⅛	69,215 2-12	22,292 ¾	319	146,119 5-12

Total length of cast iron mains	4 miles	1,847 11-12 feet
Total length of Wyckoff patent mains	23 "	1,711½ "
Total main pipe	27 miles	3 559 5-12 feet.

Stop valves put in:

	8-inch.	6-inch.	4-inch.	3-inch.	Total.
Flowers patent	3	7	27	2	39

Total stop valves in use:

	16 inch.	12 inch.	10 inch.	8 inch.	6 inch.	4 inch.	3 inch.	Total.
Flowers	1	3	11	31	85	203	5	339
Galvin	1	2	4	1	5	45	....	58
Brown	....	1	....	....	1	....	....	2
Total	2	6	15	32	91	248	5	399

Fire hydrants set:

Holly	3
Matthews	22
	25

Total fire hydrants set and in use:

Holly	131
Gaskill	15
Matthews	63
Galvin	5
Brown	1
	215

All the hydrants are double discharge, post hydrants, with 4-i inlet. Two of them have crane attachments for filling street sprinkl carts.

The whole number of leaks which have been discovered in main pipes during the year has been 26, their location and charac being as given in the following table:

Date.	Location.	Size and kind.	Character of leak.	How repai
Jan'y 7.	Alley bet Saginaw and Washington sts.	4-inch Wyckoff	....joint....	plugged.
Feb. 7.	South side Center street	6-inch "	....joint....	plugged.
" 8.	West side Water street	6-inch "	....joint....	plugged.
" 16.	In Twenty-fourth street	6-inch "	....joint....	plugged.
" 24.	In Sixth street	6-inch "	....joint....	plugged.
April 23.	In Water street	10-inch "	....joint....	plugged.
" 23.	In Harrison street	10-inch "	....joint....	plugged. [s
May 15.	Alley between Washington & Adams sts.	6-inch "	band burst.	2 new Secs.
" 19.	Eighteenth street	8-inch "	....joint....	plugged.
" 21.	Alley between Adams and Jefferson sts.	4-inch "	....joint....	plugged.
" 31.	Alley bet Jefferson and Madison sts.	8-inch "	....joint....	plugged.
June 2.	Johnson street	8-inch "	....joint....	plugged. [s
July 10.	Harrison	8-inch "	band burst.	new pipe
" 18.	Water street	10-inch "	....joint....	plugged.
" 27.	Corner Center and Trumbull sts.	4-inch "	....joint....	new thimbl
Aug. 26.	Corner Woodside and Shearer sts.	4-inch "	....joint....	new thimbl
" 29.	Alley bet Saginaw and Washington sts.	6-inch "	....joint....	plugged.
" 30.	Harrison street	10-inch "	....joint....	plugged.
" 31.	Harrison street	8-inch "	....joint...	plugged.
Sept. 11.	North side Center	6-inch "	....joint...	plugged.
Oct. 26.	Webster street	6-inch "	....joint....	plugged.
" 29.	Water street	10-inch "	..knot hole.	plugged.
" 31.	Tenth street to hydrant	4-inch Iron	.lead joint.	caulked.
Nov. 3.	Alley bet Washington and Adams sts.	6-inch Wyckoff	....plug....	plugged.
Dec. 4.	Alley bet Washington and Adams sts.	8-6 " Reducer	....joint....	plugged. [s
" 20.	West side Water street	6-inch Wyckoff	....joint....	new pipe

The cost of repairing the one leak on iron pipe was $1.00.

The cost of repairing the 25 leaks in Wyckoff pipe was: for labor, $91.23; for material, $23.57; total, $114.80.

During the months of January, February and March, 75 hydrants were found frozen, by employes of this Board, and placed in serviceable condition.

The fire department were delayed but once by frozen hydrants. Early in the morning of February 15th the department was called to extinguish a fire which had gained some headway in the residence of Mr. Joseph Eastwood, on Jackson street north of Fifth; the first two hydrants to which they coupled were both broken in attempting to open them.

The previous day had been warm, and a soft, slushy snow had fallen, the moisture from which had penetrated the space around the revolving nut in the top of the hydrants; during the afternoon and night the temperature fell some 50 degrees, being about 20 degrees below zero at the time of the fire, and the working parts of the hydrants where the moisture had penetrated were cemented as solidily as though they had been one piece of metal.

The delay thus occasioned was the cause of the almost complete destruction of the building, and was much deplored, but seemed to be almost unavoidable under the circumstances.

Meters and Services.

The number of meters set during the year was 41, of the following sizes and kinds:

	2 in.	1½ in	1 in.	¾ in.	⅝ in.	½ in.	Total.
Union Rotary	1	..	1	..	1	..	3
Union Duplex	..	..	..	..	11	..	11
Crown	..	..	1	4	..	..	5
Empire	..	..	3	7	..	1	11
Worthington	3	1	..	..	..	..	4
Jersey	..	..	1	5	1	..	7
Total	4	1	6	16	13	1	41

The number of meters taken out was 16, as follows:

	3 in.	2 in.	1½ in	1 in	¾ in.	⅝ in.	½ in.	Total.
Union Rotary	1	..	1	1	..	1	..	4
Union Duplex	..	..	..	..	..	3	..	3
Crown	..	..	..	3	1	..	..	4
Empire	.	..	..	..	..	..	2	2
Worthington	..	2	1	..	..	..	..	3
Total	1	2	2	4	1	4	2	16

Whole number of meters and motor indicators in use, 21
follows:

	8 in.	4 in.	3 in.	2 in.	1½ in.	1 in.	¾ in.	⅝ in.	½ in.	⅜ in
Union Rotary	1	5	18	6	1	2	1	1	..	..
Union Duplex	..	..	..	..	..	..	..	18	..	..
Crown	..	..	..	..	1	21	33	..	28	1
Empire	..	..	..	..	..	6	28	..	22	..
Worthington	..	..	..	5	6	..	..	4	..	..
Hersey	..	..	..	..	..	1	5	1	..	..
Total	1	5	18	11	8	30	67	24	50	1

Motor indicators 3

Of the 215 meters in use, 78 are classed as manufacturing, domestic, and 10 are test meters located on sub-mains or for mea water supplied through private pipes on extensions for the conve of consumers to settle accounts between themselves. Of the 16 removed, five were taken out by reason of the use of water bein manently abandoned through the services to which they were att seven for failure to register, and were replaced by other meters; t reason of the size being unsuited to the use of water through the were replaced by meters of suitable capacity; one by reason service to which it was attached being connected with another metered; and one was a test meter which it was not considered sary to continue in service.

Twenty-three meters were found not registering at all, the ing parts being choked with pieces of wood or other substance; were placed in working order without removing them. Twenty- were taken apart and cleaned, on account of not registering th quantity passing through them.

Ten were found broken or worn to an extent requiring repai were repaired and replaced, and two were found frozen, but we damaged to an extent requiring renewal.

The quantity of water supplied through meters for the ye 93,240,895 gallons, an increase of 20,764,876 gallons from 1887.

The use of meters is growing in favor among consumers, has been impossible to comply with all of the requests for their a tion; in some cases it would not be advisable to put them on, but cases where water closets and lawn hose are used, meters sho attached to the service as fast as circumstances will permit. Nea of the manufactories in the city are now supplied through mete few paying fixed rates should be placed under meter, that bei only equitable basis on which to supply water for such purposes.

The number of new service connections made with the main pipe was 71, as follows:

	1 inch.	¾ inch	½ inch	½ inch	Total.
With cast iron mains	1	2	1	4	8
With Wyckoff mains	12	9	23	19	63
Total	13	11	24	23	71

Number of service connections taken out..... 3
One ¾-inch and two ½-inch, all from Wyckoff main.

The whole number of service connections with main pipes is 1,463, as follows:

	8-in B	6-in B	4-in B	3-in B	2-in B	2-in	1¼-in	1-in	¾-in	½-in	½-in	⅜-in	Total.
Cast iron mains	..	2	9	..	..	2	6	44	58	88	85	5	244
Wyckoff mains	1	3	12	1	1	13	..	152	405	209	422	..	1219
Total.....	1	5	21	1	1	15	6	196	463	242	507	5	1463

Twenty-nine of these services are connected with mains by means of branch castings, and one thousand four hundred and thirty-four by corporation stop-cocks.

Eleven service connections have been abandoned and shut off at the main, making whole number of abandoned service connections 74, and the number open 1,389.

The number of separate services supplied through these open connections is 1,489, of which 1,166 are open, and 323 are closed at the stop-cock.

The number of services closed by employes of the Board during the year was 259, of which eighteen were closed by reason of the service pipe being found leaking; 67 at the request of consumer; 84 premises found vacant, and 90 for non-payment of water rates.

The number of services opened by employes of the Board during the year was 255.

Appended to this report will be found the usual statistical information.

Respectfully submitted,

E. L. DUNBAR,

Superintendent and Secretary.

Bay City, Mich., Feb. 7th, 1889.

REPORT OF ACCOUNTANT ON EXAMINATION OF BOOKS OF 188

TO THE HONORABLE BOARD OF WATER COMMISSIONERS OF THE CI
BAY CITY:

GENTLEMEN—The undersigned, an accountant, employed to
the books and accounts of the Bay City Water Works for the year
would submit the following report:

I have examined the records, vouchers, accounts and books
Secretary, also the several statements as shown in the Superinten
printed report, as follows:

Folios 4 and 5, Cash Collections.
Folio 5 shows amounts deposited with City Treasurer and dates of the same.
Folios 5 and 6, Expenditures and Monthly Reports to Common Council.
Folio 11, Account of O. Bump, treasurer, and transfer of balance to City Water Works fund, as required by ordinance.
Folio 12, Statement of Monthly Pay Rolls.
Folios 12 and 13, Ledger Balances for the year 1887.
Folios 13 and 14, Balances of all Accounts from the commencement of the construction of works to Dec. 31st, 1887.

I have also examined all assessment rolls and compared the
with stubs of receipts, and found them to agree perfectly with
other and the daily record of the same.

All of which is respectfully submitted.

(Signed) DANIEL A. MARSHA

Bay City, March 15th, 1888.

Material used in running pumping engines during the year 1888:

2,280 cords wood	costing	$1,824 00
162½ gallons cylinder oil	"	111 88
22 lbs Royal lubricant	"	4 40
5½ gallons lard oil	"	3 63
5¼ lbs Eureka packing	"	3 15
5 lbs 1-inch square rubber packing	"	2 65
1 lb ⅝ square rubber packing	"	38
7 lbs sheet rubber packing	"	4 06
2½ lbs Heston cone packing	"	3 75
3¾ lbs Hemp packing	"	93
4 lbs cotton packing	"	1 60
2½ lbs wicking	"	1 00
6 lbs valve leather	"	6 00
10 lbs rivets	"	1 00
Gaskets for boilers	"	40
2 lbs white lead	"	20
Red lead and oil	"	85
Plumbago	"	60
Tripoli, rottenstone, and acid	"	2 87
652 lbs wipers	"	38 54
Concentrated lye	"	45
10-12 dozen brooms	"	2 09
Emery paper and emery	"	62
476½ gallons kerosene oil	"	46 69
1 7-12 dozen lamp chimneys	"	1 25
Lamp wicks and matches	"	81
30 lbs British Scale Eradicator	"	6 00
470 lbs Eureka boiler compound	"	37 85
30 bars soap	"	1 30
3½ lbs sheet brass and copper	"	1 75
Ice	"	8 10
Tools, files, oil cans, etc	"	2 60
		$2,121 30

Material on hand at pumping station Dec. 31st, 1888:

6 cords wood	costing	$ 4 80
20 gallons superior cylinder oil	"	13 60
8 lbs Goodsell's patent packing	"	12 00
6 lbs ½ square rubber packing	"	2 28
11 lbs sheet rubber packing	"	6 38
9 lbs Heston cone packing	"	13 50
8 lbs hemp packing	"	2 00
2 lbs cotton packing	"	80
2 lbs wicking	"	80
16 lbs gaskets for boilers	"	8 70
1 lb red lead	"	10
2 lbs tripoli	"	20
2 lbs rottenstone	"	30
⅛ lb oxalic acid	"	13
36 gallons kerosene oil	"	3 42
5 5-12 dozen lamp chimneys	"	3 25
30 lbs Eureka boiler compound	"	2 40
13 bars soap	"	52
1 air pump valve	"	3 20
1 lb sheet brass and copper	"	50
Tools, steam hose, wrenches, etc	"	24 25
		$103 13

Uses of water supplied at fixed or schedule rates:

1 Armory.
3 Bakeries.
3 Banks.
8 Barber shops.
3 Bath rooms (public.)
1 Bath room (Turkish.)
196 Baths (private.)
5 Blacksmith shops.
11 Boarding houses.
7 Bottling works.
1 Business college.
25 Business blocks (not classified.)
10 Butcher shops.
13 Boilers (for power.)
2 Box factories.
2 Carriage shops.
3 Churches.
2 Cigar factories.
1 Cooper shop.
1 Cracker factory.
1 Creamery.
1 Cigar box factory.
1 Chapel.
658 Dwellings.
1 Express office.
80 Families in blocks.
2 Fire pipes.
2 Fountains.
1 Gas works.
4 Gas engines.
1 Green house.
1 Gun shop.
6 Halls (public.)
2 Harness shops.
31 Hotels.
309 Hose for sprinkling lawns.
5 Laundries.
1 Machine shop.
30 Offices.
1 Oil refinery.
1 Paint shop.
1 Passenger depot.
4 Photograph galleries.
2 Plumbers shops.
1 Postoffice.
1 Potash factory.
1 Plow factory.
1 Printing office.
2 Refrigerators.
10 Restaurants.
1 Rink (roller.)
56 Saloons.
1 Salt crusher.
8 School buildings (public.)
2 Soap factories.
11 Stables (livery.)
8 Stables (mill.)
150 Stables (private.)
1 Stone yard.
84 Stores.
2 Tailor shops.
2 Telegraph offices.
1 Telephone exchange.
1 Undertaker shop.
604 Water closets.
60 Water closets in schools.
6 Water motors.
1 Wood yard.
1 Warehouse.

Supplied through meters:

40 Baths (private.)
2 Bakeries.
3 Bottling works.
12 Business blocks (not classified.)
1 Barber shop.
1 Bath house (public.)
1 Brewery.
1 Billiard room.
1 Club room.
1 Carriage factory.
1 Coal and wood yard.
1 County court house.
1 County jail.
1 Creamery.
3 Churches.
1 Cooper shop.
1 Lodging house.
5 Machine shops.
14 Offices.
1 Opera house.
2 Passenger depots.
1 Pipe works.
10 Planing mills.
3 Printing offices.
2 Restaurants.
1 Railroad round house.
1 Reel factory.
13 Salt blocks.
13 Saw mills.
6 Saloons.
2 Stables (hotel.)
6 Stables (livery.)

118 Dwellings.
11 Drill houses.
1 Elevator.
1 Fountain.
2 Flour mills.
5 Foundries.
1 Gas engine.
1 Green house.
48 Hose for sprinkling.
1 Hospital.
15 Hotels.
2 Laundries.
8 Stables (mill.)
25 Stables (private.)
2 Stables (street car.)
12 Stores.
1 School.
1 Soap works.
2 Wooden ware works.
8 Water motors.
158 Water closets.
21 Pipes on which hydrants or hose connections are located for fire protection.

City use not paid for:

1 City building occupied by police station and city offices.
1 City building occupied by public library and city offices.
6 City hose houses and stables.
15 Water closets in city buildings.
1 Electric light works.
8 Public water troughs.
2 Ornamental fountains in public parks.
7 Hose for sprinkling public parks.
215 Public fire hydrants.

Premises shut off:

1 Bank.
2 Boiler shops.
7 Baths (private.)
5 Blacksmith shops.
1 Boarding house.
5 Business blocks (not classified.)
1 Butcher shop.
1 Cemetery.
1 Cigar factory.
1 Barber shop.
139 Dwellings.
4 Drill houses.
2 Elevators.
1 Foundry.
1 Gun shop.
32 Hose for sprinkling lawns.
2 Hotels.
12 Hydrants for fire protection.
1 Kindling factory.
1 Market garden.
1 Mortar yard.
1 Machine shop.
2 Offices.
1 Plumber shop.
3 Pasture lots.
1 Rink (roller.)
1 Railroad round house.
1 Restaurant.
7 Saloons.
2 Shops.
5 Salt blocks.
3 Saw mills.
1 Shingle mill.
7 Stables.
37 Stores.
1 Slaughter house.
21 Water closets.
45 Vacant lots.
8 Vacant buildings and basements.

List of premises where meters are attached:

Manufacturing Meters

Name of consumer.	Use.	Size.	Kind.
McEwan Bros. & Co.	Saw mill, etc.	3 inch.	Union Rotary.
Dolsen, Chapin & Co.	Planing mill	1½ inch.	Worthington
" " "	Drill house	¾ inch.	Crown
" " "	Saw mill, etc.	3 inch.	Union Rotary
" " "	Salt block, etc	2 inch.	" "
Eddy Bros. & Co.	Saw mill, etc.	3 inch.	" "
Folsom & Arnold	Saw mill, etc.	4 inch.	" "
" "	Drill houses, etc.	3 inch.	" "
Edmund Hall	Saw mill etc	2 inch.	" "
" "	Drill houses, etc.	¾ inch.	Crown
" "	Stable	½ inch.	Crown
The Michigan Pipe Company	Pipe works	4 inch.	Union Rotary
" " "	Pipe works, etc	3 inch.	Union Rotary
C. Hiller	Planing mill	¾ inch.	Crown
Bay City Buggy Company	Carriage factory	¾ inch.	Empire
F. & P. M. R. R. Company	Round house, etc	1 inch.	Crown
Bay City Iron Company	Machine shop, etc.	1 inch.	Crown
Pitts & Cranage	Planing mill, etc.	3 inch.	Union Rotary
" "	Saw mill, etc.	4 inch.	" "
" "	Salt block, etc	3 inch.	" "
J. N. McDonald & Son	Flour mill	2 inch.	Worthington
Marine Iron Works	Machine shop	¾ inch.	Crown
Mich. Central R. R. Co.	Round house, etc	2 inch.	Worthington
Bay City Tribune Company	Printing office	¾ inch.	Crown
Laing & Wilcox	Printing office	½ inch.	"
S. G. M. Gates	Office	½ inch.	"
" "	Saw mill, etc.	3 inch.	Union Rotary
First Baptist Church	Organ motor, etc.	2 inch.	Worthington
C. B. Chatfield & Co.	Flour mill	1½ inch.	Worthington
S. G. M. Gates	Mill stable	¾ inch.	Empire
F. E. Bradley & Co.	Office	¾ inch.	Union Duplex
" "	Saw mill, etc.	4 inch.	Union Rotary
National Boiler Works.	Boiler shop	½ inch.	Crown
Madison Ave. M. E. Church	Organ motor	2 inch.	Worthington
Eddy, Avery & Eddy	Hydrants	3 inch.	Union Rotary
" "	Cooper shop, etc.	¾ inch.	Crown
" "	Saw mill, etc.	3 inch.	Union Rotary
" "	" "	¾ inch.	Crown
Eddy, Avery & Eddy and Smalley Bros. & Co.,	Drill house, etc. / Machine shop, etc.	3 inch.	Union Rotary
McKinnon Manufacturing Co.	" "	¾ inch.	Crown
Wm. Peter	Saw mill, etc.	3 inch.	Union Rotary
N. B. Bradley & Sons	"	3 inch.	" "
" "	Office	¾ inch.	Empire
" "	Drill house	1 inch.	Crown
Ross, Bradley & Co.	Planing Mill	1½ inch.	Crown
" "	" "	4 inch.	Union Rotary
Matthew Lamont	Planing mill, etc.	1½ inch.	Worthington
" "	" "	¾ inch.	Empire
N. B. Bradley & Sons.	Salt block, etc.	1½ inch.	Union Rotary
Butman & Rust	Saw mill, etc.	2 inch.	Union Rotary

Butman & Rust	Salt block, etc	1	inch	Crown	37 79
Rust Bros. & Co	" "	1	inch	Union Rotary	40 30
" "	Saw mill, etc	3	inch	Union Rotary	154 81
Bay City Brewing Co	Brewery	1	inch	Crown	36 50
" "	"	1	inch	Empire	31 75
" "	"	1	inch	Crown	38 20
" "	Bottling works	1	inch	Crown	34 50
G. Hine	Slaughter house	½	inch	Empire	19 82
E. F. Rouse	Reel factory	¾	inch	Empire	24 36
R. J. Briscoe Mill and Lumber Co	Planing mill	1	inch	Hersey	31 81
G. H. Merrill & Co	Planing mill	1	inch	Empire	30 82
S. McLean Son & Co	Saw mill, etc.	2	inch	Union Rotary	76 37
" "	Office, etc	½	inch	Crown	18 67
" "	Salt block, etc	1	inch	Crown	49 87
Standard Machinery Co	Machine shop, etc	2	inch	Worthington	57 57
Valley Soap Works	Soap factory	1	inch	Empire	33 48
Miller & Lewis	Shingle mill	1	inch	Union Rotary	36 57
" "	Saw mill, etc	3	inch	Union Rotary	136 22
" "	Office	⅝	inch	Union Duplex	21 42
" "	Planing mill	¾	inch	Crown	28 00
" "	Drill houses	1	inch	Crown	38 30
B. H. Briscoe & Co	Planing mill	1½	inch	Worthington	49 75
Hitchcock & Bialy	Saw mill, etc	3	inch	Union Rotary	113 31
Bousfield, Perrin & Co	Woodenware works	3	inch	Union Rotary	115 65
R. M. Bradley	Box factory	3	inch	Union Rotary	118 05
T. H. McGraw & Co	Salt block, etc.	8	inch	Union Rotary	952 17
J. L. Gould	Market garden	2	inch	Union Rotary	66 23
Bousfield & Co	Woodenware works	2	inch	Union Rotary	66 76

Elevators and Motor Indicators.

Bay City Building Co	Elevator Phœnix blk	6	inch		
Romer, Lovell & Co	Elevator Shearer blk	4	inch		32 50
Trinity Church	Organ Motor	2	inch		85

Domestic Meters.

Name of consumer.	Use	Size	Kind	Cost.
Abe Watts	Hotel	1½ inch	Crown	18 30
Louis Cormier	Bottling works	⅝ inch	Union Duplex	20 71
" "	Hotel	½ inch	Crown	17 33
Matilda Seymour	Dwelling	½ inch	Empire	19 00
Sandy Anderson	Hotel	½ inch	Empire	22 50
Michigan Central R. R. Co	Passenger depot	¾ inch	Crown	25 20
" "	Offices	⅝ inch	Union Duplex	21 18
F. Hamme & Co	Bakery	½ inch	Empire	17 50
John Wald	Dwelling	½ inch	Empire	15 75
W. I. Brotherton & Co	Wholesale grocery	¾ inch	Empire	21 53
E. Eickemeyer	Bridge block	¾ inch	Crown	28 95
O. W. Odell	Hotel	¾ inch	Crown	38 00
"	Hotel	½ inch	Crown	18 09
"	Hotel	¾ inch	Crown	28 00
"	Hotel	¾ inch	Crown	15 75
Peter LaFranc	Livery stable	¾ inch	Crown	31 26
Becktel & Son	Hotel	¾ inch	Crown	29 07
E. E. Burroughs	Livery stable	½ inch	Crown	18 66
L. H. Griffin	Block	¾ inch	Crown	25 65
Henry Birney	Livery stable	¾ inch	Crown	27 85
Geo. H. Schindehette	Hotel	¾ inch	Crown	35 31

Hurley Bros.	Block	¼ inch	Empire
H. Tupper M. D.	Dwelling	¾ inch	Crown
"	Barn	½ inch	"
Geo. Cooke	Hotel	1 inch	"
R. J. Parker	Hotel	½ inch	"
J. G. Buchanan	Hotel	¾ inch	"
F. & P. M. Railroad Co.	Passenger depot	¾ inch	"
Z. H. Evans, M. D.	Dwelling	½ inch	Empire
Mrs. J. Ramsdell	Dwelling	¾ inch	Empire
John Mansfield	Dwelling	⅝ inch	Hersey
George S. Benson	Watson block	¾ inch	Crown
" "	Watson block	½ inch	Crown
M. J. Thomas	Laundry	⅝ inch	Union Duplex
Hurley Bros.	Block	½ inch	Empire
A. H. Dey	"	½ inch	Crown
Mrs. C. B. Cottrell	"	½ inch	Empire
Young Bros	Office, etc	¾ inch	Empire
F. E. Tyler	Livery stable	¾ inch	Crown
Albert Daglish	Livery stable	½ inch	"
J. F. Antisdel	Hotel	1 inch	"
	"	1 inch	Empire
	"	¾ inch	Union Rotary
A. N. Rouech	Hotel, etc	1 inch	Crown
"	"	¾ inch	Empire
Bay County Milk Association	Creamery, etc	½ inch	Empire
Bay City Building Co.	Phœnix block	¾ inch	Hersey
" "	" "	1 inch	Crown
Phillippi & Foote	Barber shop & baths	¾ inch	"
C. M. Averell	Block	¾ inch	"
John McDermott	Block, etc	½ inch	Empire
Wood's Opera House Co.	Opera house block	1 inch	Crown
F. E. Bradley	Dwelling	¾ inch	Empire
Peter Kelson	Hotel	½ inch	Crown
Wm. Fox	Hotel	¾ inch	Empire
W. D. Sherman	Livery stable	¾ inch	Empire
Ben Conklin, sheriff	Bay county jail	¾ inch	Crown
Bay County	Court house	1 inch	Crown
Seth McLean	Dwelling	⅝ inch	Union Duplex
"	Barn	¾ inch	Empire
Fred A. Lewis	Dwelling	⅝ inch	Union Duplex
R. W. Erwin, M. D.	Dwelling, etc	¾ inch	Empire
H. B. Landon, M. D.	Dwelling, etc	¾ inch	Crown
Mrs. A. F. McEwan	Dwelling	¾ inch	Empire
" "	Barn	½ inch	Crown
F. E. Tyler	Dwelling	½ inch	Empire
"	Barn	⅝ inch	Worthington
James B. Shearer	Dwelling	½ inch	Crown
B. E. Warren	Dwelling, etc	¾ inch	"
T. E. Webster	Dwelling	½ inch	"
F. S. McGraw	"	¾ inch	Empire
Geo. Young	"	¾ inch	Crown
Wm. Westover	"	¾ inch	Empire
Trinity Church	Church	½ inch	Crown
John Drake	Dwelling	⅝ inch	Union Duplex
C. A. Eddy	"	¾ inch	Crown
C. H. Bradley	"	¾ inch	Empire
N. Dunham	"	¾ inch	"

C. H. Shearer	Dwelling	½	inch	Crown	25 69
D. A. Watrous	"	⅝	inch	Union Duplex	19 99
"	Barn	⅝	inch	Worthington	19 52
Jas. E. Whitney	Dwelling	⅝	inch	Union Duplex	20 16
W. I. Brotherron	"	½	inch	Crown	14 61
A. A. Knopfell	"	½	inch	"	16 57
John K. Mason	"	½	inch	"	14 87
J. W. McGraw	"	¾	inch	Empire	22 00
"	Barn	⅝	inch	Hersey	22 40
C. C. Whitney	Dwelling	½	inch	Crown	17 00
Fred W. Bradley	Dwelling, etc	⅜	inch	Hersey	26 53
John McEwan	"	½	inch	Crown	17 38
S. V. Wilkin	"	⅝	inch	Empire	20 72
W. O. Clift	"	⅝	inch	Union Duplex	17 97
H. Griswold	"	½	inch	Crown	14 47
S. B. Warren	Dwelling	⅝	inch	Worthington	13 92
W. G. Witthauer	"	½	inch	Empire	13 75
W. E. Teall	"	½	inch	"	14 25
Jas. McKeon	" etc	½	inch	"	15 88
Wm. L. Clements	"	¾	inch	Crown	25 55
Arbeiter U. V. Society	Hall, etc	¾	inch	Hersey	22 73
Chas. Breitmeyer	Greenhouse, etc	¾	inch	Crown	28 70
Bay City Street R. R. Co	Stable	¾	inch	Empire	26 00
C. A. E. Weadock	Dwelling	⅝	inch	Union Duplex	17 87
Orrin Bump	"	½	inch	Empire	14 00
S. Hine	"	½	inch	"	19 50
Mrs. R. J. Carney	"	¾	inch	"	27 12
S. F. Greenizen	" etc	⅝	inch	Union Duplex	22 87
S. M. Green	"	¾	inch	Empire	26 59
Madison Ave. M. E. Church	Church	¾	inch	"	24 42
John Thompson	Dwelling	½	inch	Crown	19 41
H. H. Thomas	" etc	⅝	inch	Worthington	18 36
L. A. Pratt	" "	⅝	inch	Union Duplex	20 46
L. F. Rose	" "	½	inch	Empire	15 50
Alfred Mosher, Jr	"	⅝	inch	Union Duplex	19 53
S. T. Holmes	" etc	1¼	inch	Worthington	56 53
W. O. Lewis	"	⅝	inch	Union Duplex	21 01
Elmer E. Bradley	" etc	¾	inch	Hersey	24 73
Ed. Atkinson	" "	½	inch	Empire	19 05
Ed. Stenger	" "	½	inch	Empire	18 90
Pat Ryan	Mortar yard	⅝	inch	Union Duplex	20 63
Miss Birney	Dwelling	½	inch	Empire	15 70
North Western Hospital Co	Hospital	¾	inch	"	24 15
Thomas Shiler	Hotel, etc	¾	inch	"	25 00
I. Joblinski	Block	⅝	inch	Union Duplex	17 31
Rev. M. Matkowski	Dwelling, etc	¾	inch	Empire	26 00
J. J. Hime	Hotel	½	inch	Empire	17 50
C. R. Faucher & Co	"	1	inch	Crown	42 43
Bay City Street R. R. Co	Stable, etc	1	inch	Crown	45 02

Test Meters.

Fox & Lewis	Tribune Co meter	⅝	inch	Union Rotary	12 95
A. Vanden Brooks	Water closets	½	inch	Crown	24 80
James Shearer	Central block	1¼	inch	Worthington	53 78
Fifth Street, n side, w of Johnson St	Private main	1	inch	Crown	36 13
Center Ave, s side, e of McLellan St	" "	1	inch	"	38 06

Seventh St., n side, w of Van Buren..	Private main.....	1	inch..	Empire.....
Grant St., e side, n of Ninth St.....	" "	1	inch..	Crown.....
Tenth St., s side, w of Washington St.	" "	1	inch..	" .....
Tenth St., s side, e of Madison.....	" "	1	inch..	Empire.....
Thirteenth St , s side, e of Monroe...	" "	¾	inch..	Crown.. .....

Meters in stock per inventory.....
Meter connections, etc., per inventory.....
Labor on 34 meters taken out and not replaced.....

Summary of Statismics.

Report of 1888.

Bay City Water Works, Bay County, Michigan.
Population by census of 1884, 29,415.
Date of construction, 1872.
By whom owned, city.
Source of supply, Saginaw Bay, an arm of Lake Huron.
Mode of supply, direct pumping.

Pumping.

1. Builders of pumping machinery, Holly Manufacturing Co., Lockport, N. Y.
2. Description of fuel, pine slabs and edgings.
3. Fuel consumed for the year, 2,280 cords wood—cost per cord, 80 cents. Equal to coal, 1,295,600 lbs.
6. Total pumpage in gallons, 872,990,164.
8. Average dynamic head against which pumps work, 109.3 feet.
9. Number of gallons pumped per lb. coal, 674.
10. Duty $= \frac{872{,}990{,}164 \times 8.34 \times 100 \times 109.3}{1{,}295{,}600} = 61{,}422{,}087.$

Cost of pumping, figured on pumping station expenses, $5,722.74.

11. Per million gallons pumped, $6.55.
12. Per million gallons raised one foot high, $0.06.

Cost of pumping figured on total maintenance, including interest paid by city, $10,329.25.

13. Per million gallons pumped, $11.20.
14. Per millions gallons raised one foot high, $0.12.

RECEIPTS—DIVISION I.			EXPENDITURES.		
A.—Water rates, domestic	$15,525 54		A. A.—Management and repairs, except interest	$10,249 25	
B.—Water rates, manufacturing	5,806 89		B. B.—Interest on bonds paid by tax levy	29,360 00	
C.—Net receipts from water		$21,332 43	Interest paid by water works	720 00	
D.—Miscellaneous, service connections, rents, etc.		529 50	C. C.—Total maintenance for year		$40,329 25
E.—Total		21,861 93	Bonds paid by tax levy		9,500 00
From Public funds—			D. D.—Balance to construction		11,057 68
J.—Tax levy, for interest	29,360 00				$60,886 93
Tax levy to pay bonds maturing	9,500 00				
Furniture and fixtures, sale of safe	165 00				
		39,025 00			
K.—Total		$60,886 93			
DIVISION II.					
From fixed rates—					
L.—Domestic	12,557 26				
M.—Manufacturing	631 88				
N.—Total		13,189 14			
From meter rates—					
O.—Domestic	2,968 28				
P.—Manufacturing	5,175 01				
Q.—Total		8,143 29			

CONSTRUCTION.

R.—From balance of previous year	$ 5 415 86		F. F.—Extension of mains	$ 9,015 60	
From balance from maintenance	11,057 68		H. H.—Water meters	552 33	
	$16,473 54		Furniture and fixtures	353 50	
			I. I.—Total for construction		$9,921 43
			J. J.—Balance		6,552 11
					$16,473 54

W.—Net cost of works to date	$440,078 35	
X.—Bonded debt, city bonds	357,500 00	Interest 8 per cent.
Bills payable	18,000 00	Interest 4 per cent.



Consumption.

1. Estimated population at date, 34,000.
2. Estimated population on lines of pipe, 17,000.
3. Estimated population supplied, 11,000.
4. Total gallons consumed, 872,990,164.
5. Passed through domestic meters, 30,848,392 gallons, 3½ per cent.
6. Passed through manufacturing 62,392,503 gallons, 7 1-10 per ce
7. Average daily consumption, 23
8. Gallons per day to each inhabit
9. Gallons per day to each consum
10. Gallons per day to each servi bution 22) 1,717.

Distribution.

Mains.

1. Cast iron and Wyckoff.
2. Sizes from 3-inch to 20-inch.
3. Extended 11,704½ feet.
4. Abandoned, 102½ feet.
5. Total in use, 27¾ miles.
6. Cost of repairs, $22 05 per mile.
7. Leaks per mile, 1.
8. Small distribution less than 4-in, 319 ft.
9. Hydrants added, 25.
10. Number in use, 215.
11. Stop gates added, 39.
12. Number in use, 399.
13. Small stop gates less than 4-inch, 5.
14. Number of blow-off gates, 21.
15. Range of pressure at center for night, 28 to 33 lbs.

Services.

16. Lead, wrought iron and Wycko
17. Size ¾-inch to 8-inch.
21. Service taps added, 57.
22. Number in use, 1,389.
25. Meters added, 25.
26. Number in use, 215.
    Domestic, 127.
    Manufacturing, 78.
    Test, 10
27. Motors and elevators added, 8
28. Number in use 16

EIGHTEENTH

ANNUAL REPORT

—OF THE—

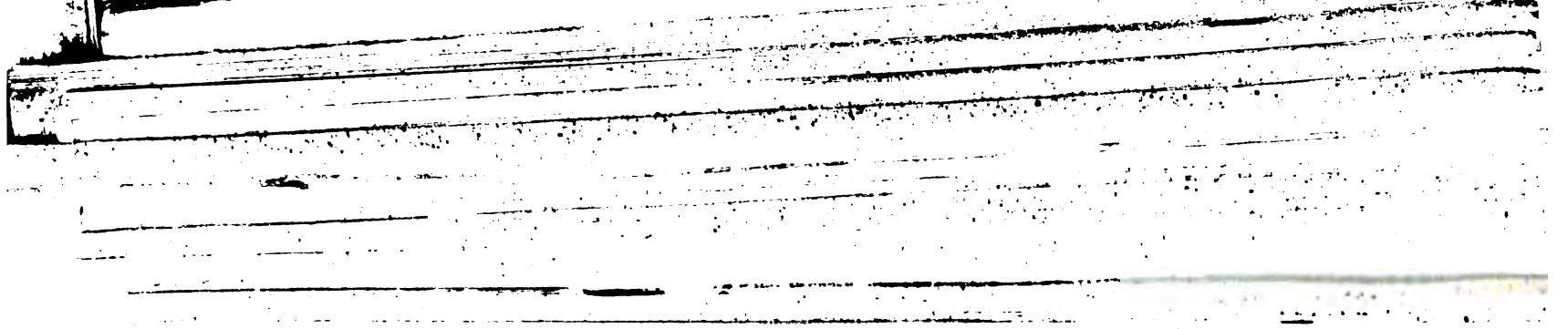
SUPERINTENDENT

—OF—

WATER WORKS.

BAY CITY, MICH.

FOR 1889.



Compliment

E.

EIGHTEENTH ANNUAL REPORT

—OF THE—

SUPERINTENDENT

—OF—

WATER WORKS.

****

BAY CITY, MICH.

****

FOR 1889.



Bay City, Michigan.

Water Department.

1889.

Commissioners.

ANDREW WALTON, PRESIDENT.
(Term expires Sept. 6th, 1894.)

G. HENRY SHEARER.
(Term expires Sept. 6th, 1895.)

BENJAMIN F. RAY.
(Term expires Sept. 6th, 1896.)

JOHN D. McKINNON.
(Term expires Sept. 6th, 1890.)

LOUIS MORITZ.
(Term expires Sept. 6th, 1891.)

DUNCAN McGREGOR.
(Term expires Sept. 6th, 1891.)

GEO. C. MYERS.
(Term expires August 4th, 1890.)

Superintendent and Secretary ....E. L. DUNBAR.
Office Assistant .....T. A. DELZELL.
Inspector .....FRANK H. COLLINS.
Reservoir Keeper .....LEVI D. CARPENTER.

First Engineer.....A. B. VERITY.
Second Engineer.....FRED H. HOLLY.
Fireman .....A. J. CARPENTER.
Fireman .....PATRICK O'HARE.

SUPERINTENDENT'S REPORT.

To the Honorable Board of Water Commissioners of Bay City, Michigan:

GENTLEMEN—I have the honor to submit the Eighteenth Annual Report of the Water Works Department of this city, showing its operations for the year ending December 31st, 1889.

The membership of the Board continues unchanged. The term of office of Commissioner D. McGregor expired Aug. 4th, 1889, and that of Commissioner B. F. Ray Sept. 6th, 1889. Both of these gentlemen were re-appointed by the Common Council on the nomination of the Mayor at their session of Aug. 26th, 1889; Mr. Ray being appointed for the term of seven years from Sept. 6th, 1889, and Mr. McGregor for the term of two years from the same date.

At a regular session of the Board of Water Works, held November 26th, 1889, Commissioner Andrew Walton was re-appointed President of the Board for the ensuing year, and E. L. Dunbar was re-appointed Secretary.

FINANCIAL.

Receipts.

The receipts of the department during the year have been $22,775.65, an increase of $913.72 from the year 1888. This increase has been principally from water rates.

The receipts have been from the following accounts:

From water rates roll of	1880	$ 5 00
" " "	1881	10 00
" " "	1882	10 00
" " "	1883	1 33
" " "	1884	2 50
" " "	1885	3 50

From water rates roll of 1886	$ 8 10	
" " " 1887	8 60	
" " " 1888	92 24	
" " " 1889	22,078 13	
Total from water rates		$22,220
Plumbers' licenses	$ 45 00	
Rent of boom	200 00	
Sale of service connections	309 50	
Repairs on main distribution	75	
Total miscellaneous		$ 555
		$22,775

The total amount charged on roll of 1889 was $22,233.50; collected, $22,078.13; leaving uncollected $155.37; all of v due on premises shut off, or where occupants have removed.

The total amount on roll of 1889 is:

For water supplied at fixed or schedule rates	$13,704
" " at meter rates	8,435
" " for building purposes	93
	$22,233

The amount collected on roll of 1889 was:

For water supplied at fixed or schedule rates	$13,608
" " at meter rates	8,397
" " for building purposes	72
	$22,078

The amount uncollected on roll of 1889 is:

From fixed or schedule rates	$ 96
From meter rates	37
From building purposes	21
	$155

The amounts collected have been deposited with the Ci urer, as required by Section 156 of the City Charter, per re file, as follows:

January 31st, 1889	$ 1,360
February 28th, "	1,638
March 30th, "	1,528
April 30th, "	2,371
May 31st, "	1,113
June 29th, "	2,009
July 31st, "	2,468
August 31st, "	1,499
September 30th, "	1,780
October 31st, "	2,758
November 30th, "	1,087
December 31st, "	3,342
	$22,775

The total amount of water rates collected and uncollected on each year's roll since the works commenced operations, have been as follows:

YEAR.	COLLECTED.	UNCOLLECTED.	TOTAL ON ROLL.
1873—January 1st to April 30th	$ 728 82		$ 728 82
1873-4—May 1st, 1873 to April 30th 1874	5,440 80	$ 1 60	5,442 40
1874-5—May 1st, 1874 to April 30th 1875	6,908 16	44 85	6,953 01
1875—May 1st to December 31st	7,269 55	28 46	7,298 01
1876	9,571 26	82 73	9,653 99
1877	9,604 26	134 19	9,738 45
1878	10,078 15	324 71	10,402 86
1879	11,708 97	136 07	11,845 04
1880	13,155 74	120 25	13,275 99
1881	14,996 61	218 40	15,215 01
1882	17,350 67	160 65	17,511 32
1883	18,713 46	98 64	18,812 10
1884	18,890 77	133 89	19,024 66
1885	19,713 50	273 81	19,987 31
1886	19,344 61	130 74	19,475 35
1887	19,427 75	95 50	19,523 25
1888	21,245 60	154 19	21,399 79
1889	22,078 13	155 37	22,233 50
Totals	$246,226 81	$2,294 05	$248,520 86

The following amounts heretofore reported uncollected, have been cancelled by resolution of the Board adopted November 26th, 1889:

On roll of 1880, $5.00; roll of 1881, $10.00; roll of 1882, $10.00; total, $25.00.

The total amount remaining uncollected on the 18 rolls is less than one per cent of the total amount of said rolls. In view of the fact that the water rates are not a lien upon the property, and are in a large percentage of cases collected from temporary occupants, this does not seem a discreditable showing, though the per cent is large when compared with other cities, where the rates are almost invariably a lien upon the property, and paid by the owners.

The total receipts of the Board from all sources since its organization have been as follows:

Received from city (proceeds of $377,000 city bonds)	$368,045 87
Received from city frontage tax (assessed in 1874 only)	736 07
Water rates collected	246,226 81
Net receipts from sale of service connections, plumbers' licenses, &c	4,506 80
Bills payable—time orders issued to Holly Mfg. Co	18,000 00
	$637,515 55

Expenditures.

The expenditures of the department during the year have $22,505.52, an increase of $614.84 over the expenditures for 188

Order No. 1 for $4,500, of the special orders issued in 1886 Holly Manfg. Co. in payment for Gaskill pumping engines, became due November 1st, 1889, was paid from the receipts of th partment; also the annual interest on the entire $18,000 of these

The main distribution has been extended a little more tha miles, at a cost of $6,924.69; and 31 meters have been added at of $580.72.

The cost of maintenance, including the items of interest mentioned, was $10,500.11, which is $469.14 less than for 1888.

The expenditures have been for the following accounts:

For maintenance accounts—

Office department:

Salaries	$ 2,115 15	
Office expenses	449 73	
		$ 2,564 88

Street and service department:

Repairs on main distribution	$ 270 89	
Repairs on services and shutting off water	267 81	
Repairs and care of water meters	314 24	
Repairs and care of inlet works	456 91	
Service connections	132 45	
		$ 1,442 30

Pumping department:

Salaries	$ 3,480 00	
Fuel	1,667 25	
Oil, packing and supplies	338 11	
Repairs on engines and boilers	256 64	
Repairs on boiler arches	14 50	
		$ 5,776 50

Repairs on buildings, etc.:

Repairs to engine house	$ 16 43	
		16 43

Interest:

Interest on time orders issued in payment for pumping engines	$ 720 00	
		720 00
Total for maintenance accounts		$10,500 11

For construction accounts—

Water meters:

Meters and setting	$ 580 72	
		$ 580 72

Main distribution:

Wyckoff pipe	$ 4,947 98	
Iron pipe and branch castings	114 87	
Valves	335 40	
Hydrants	420 00	
Laying pipe	1,106 44	
		$ 6,924 69
Total for construction accounts		$ 7,505 41

Bills payable—

Special order No. 1 on account of pumping machinery	$ 4,500 00
Total expenditures	$22,505 52

In compliance with the requirements of Section 156 of the City Charter, a statement of accounts against the department has been filed each month with the City Recorder, who has thereupon issued an order for the amount of such statement, which order has been deposited with the City Treasurer, and the several accounts paid by orders drawn by the Secretary of the Board on the City Treasurer. The amounts so paid constitute the entire expenditures of the Board, and have been reported to the Common Council each month.

The expenditures by months have been as follows:

January	$ 819 11	
February	841 89	
March	1,191 51	
April	766 28	
May	901 97	
June	859 48	
July	2,351 12	
August	3,423 29	
September	3,053 35	
October	6,624 20	
November	829 30	
December	844 02	
		$22,505 52

In addition to the expenditures of the Board as above stated, the City Treasurer has paid from moneys raised by tax levy, the annual interest on outstanding bonds issued for the construction of water works, amounting to $28,560.00, and $10,500.00 of the principal of said bonds, being bond No. 16 ($500.00) of series No. 2, due October 15, 1888, and not presented for payment until after the completion of my last annual report, and entire series No. 3 ($10,000.00) of said bonds due October 15, 1889.

The entire expenditures of the Board for all purposes, since commencement of the construction of the works, has been:

For construction accounts	$447,588 76
For maintenance accounts (net cost)	178,609 55
For bills payable	4,500 00
	$630,698 31

The entire amount paid by the City Treasurer from moneys ra by tax levy, and which does not pass through the accounts of Board, has been:

For interest on water works bonds (less coupons not presented for payment	$489,600 00
Water works bonds (Series Nos. 1, 2 and 3)	30,000 00
	$519,600 00

Accounts with water works fund and City Treasurer:

The balance in water works fund Jan. 1st, 1889, was	$ 6,552 11
Cash collections deposited by Secretary with City Treasurer and placed in water works fund	22,775 65
	$29,327 76

Amounts withdrawn from water works fund and deposited with City Treasurer, act Treasurer for the Board, as per statement of claims filed with the City Recorder Secretary:

Statement No. 25,	filed	January 30th, 1889	$ 819 11	
" 26,	"	February 27th, "	841 89	
" 27,	"	March 29th, "	1,191 51	
" 28,	"	April 29th, "	766 28	
" 29,	"	May 29th, "	901 97	
" 30,	"	June 28th, "	859 48	
" 31,	"	July 31st, "	2,351 12	
" 32,	"	August 31st, "	3,423 29	
" 33,	"	Sept. 30th, "	3,053 35	
" 34,	"	October 30th, "	6,634 20	
" 35,	"	Nov. 29th, "	829 30	
" 36,	"	Dec. 31st, "	844 02	
				$22,505 52
Balance in water works fund December 31st, 1889				6,822 24
				$29,327 76

Amount deposited with City Treasurer in his capacity as Treasurer of the Board, being Recorder's warrants No. 240 to 251, inclusive $ 22,

Amount of orders drawn on the Treasurer by the Secretary of the Board, being orders No. 522 to 786, inclusive $ 22,

Ledger Balances.

Balance of accounts for 1889.

Ledger D.	Debit	Cre
Folio 150, Water rates roll of 1880		$
" 150, " " " 1881		
" 150, " " " 1882		

Folio 143,	Water rates roll of 1883			$ 1 38
" 144,	" " " 1884			2 50
" 144,	" " " 1885			3 50
" 143,	" " " 1886			8 10
" 143,	" " " 1887			8 60
" 144,	" " " 1888			93 24
" 148,	" " " 1889			22,078 13
" 149,	Plumbers' licenses			45 00
" 149,	Rents, dockage, etc			200 00
" 157,	Service connections			177 05
Folio 142,	City water works fund	$ 270 13		
" 151,	Office department, salaries	2,115 15		
" 152,	" " expense	449 73		
" 154,	Street and service department, repairs on main distribution	270 14		
" 155,	" " " " services etc	267 81		
" 156,	" " " " and care of meters	314 24		
" 158,	" " " " " inlet works	456 91		
" 160,	Pumping department, salaries	3,480 00		
" 161,	" " fuel	1,667 25		
" 162,	" " oil, packing and supplies	338 11		
" 163,	" " repairs on engines and boilers	256 64		
" 164,	" " " boiler arches	14 50		
" 165,	Repairs on buildings. Repairs on engine house	16 43		
" 165,	Interest	720 00		
" 166,	Water meters	580 72		
" 167,	Main distribution, iron pipes and branches	114 87		
" 167,	" " Wyckoff pipe	4,947 98		
" 168,	" " valves	335 49		
" 168,	" " fire hydrants	420 00		
" 169,	" " laying pipe	1,106 44		
" 169,	Bills payable	4,500 00		
		$ 22,642 45	$ 22,642 45	

Balance of all accounts from January 1st, 1872:

	Ledger D.	Debit.	Credit.
Folio 401,	Office expenses and salaries	$ 36,250 19	
" 401,	Repairs and care of hydrants valves, and pipes	10,348 59	
" 402,	Repairs and care of water meters	1,194 60	
" 402,	Repairs and care of reservoir and inlet works	8,335 80	
" 403,	Repairs to engine house	1,192 06	
" 403,	Repairs to dock	13 38	
" 404,	Engineers' and firemen's wages	59,432 84	
" 404,	Fuel	45,753 83	
" 405,	Oil, packing and supplies	6,883 33	
" 405,	Repairs to pumping machinery	4,921 20	
" 406,	Repairs to engine foundations	51 46	
" 406,	Repairs to boiler arches	942 90	
" 407,	Implements and tools. (Repair account.)	1,129 37	
" 407,	Interest account	2,160 00	
" 408,	Water works fund	6,822 24	
" 418,	Real estate	6,724 83	
" 418,	Dock, tramway and store shed	1,882 63	
" 419,	Engine house, chimney and wells	19,097 42	
" 419,	Engine foundations, boiler foundations and arches	5,881 87	
" 420,	Pumping machinery	57,673 05	

Folio 420,	Inlet from Saginaw river	$ 3,218 99	
" 421,	Inlet from Saginaw bay	84,778 37	
" 421,	Reservoir, breakwater, etc., at bay	24,713 78	
" 422,	Iron pipe and branch castings	59,919 22	
" 422,	Wyckoff patent pipe	96,369 56	
" 423,	Public fire hydrants	10,093 09	
" 423,	Valves for street mains	10,818 00	
" 424,	Laying pipe	39,254 18	
" 424,	Buildings at bay	452 46	
" 425,	Water meters	11,586 11	
" 425,	Furniture and fixtures	990 96	
" 426,	Implement account. (Construction)	1,713 61	
" 426,	Engineering and general superintendence. (Construction)	7,856 17	
" 427,	Travelling expenses, (Construction)	306 29	
" 427,	Insurance. (Construction)	29 00	
" 428,	Interest discounts and commissions. (Construction)	4,224 17	
Folio 410,	Water rates rolls 1872-1880 inclusive		$ 74
" 410,	" " roll of 1881		14
" 411,	" " " 1882		17
" 411,	" " " 1883		18
" 412,	" " " 1884		18
" 412,	" " " 1885		19
" 413,	" " " 1886		19
" 413,	" " " 1887		19
" 414,	" " " 1888		21
" 414,	" " " 1889		22
" 415,	Plumbers' licenses		
" 415,	Rents, dockage, etc		1
" 416,	Service taps and stop boxes		2
" 416,	Bills payable		17
" 417,	Bay City bond account		360
" 417,	Water assessment. (Frontage tax)		
		$633,015 55	$633

Water Works Bonds Outstanding.

Series.	Date of Issue.	When Payable.	Amount.	Interest.
No. 4	January 15, 1872	October 15, 1890	$10,000 00	8 per cent.
" 5	" 15, 1872	" 15, 1891	10,000 00	"
" 6	" 15, 1872	" 15, 1892	10,000 00	"
" 7	" 15, 1872	" 15, 1893	10,000 00	"
" 8	" 15, 1872	" 15, 1894	10,000 00	"
" 28	October 15, 1874	" 15, 1894	10,000 00	"
" 9	January 15, 1872	" 15, 1895	10,000 00	"
" 29	October 15, 1874	" 15, 1895	10,000 00	"
" 10	January 15, 1872	" 15, 1896	10,000 00	"
" 30	October 15, 1874	" 15, 1896	10,000 00	"
" 11	January 15, 1872	" 15, 1897	10,000 00	"
" 31	October 15, 1874	" 15, 1897	10,000 00	"
" 12	January 15, 1872	" 15, 1898	8,000 00	"
" 32	October 15, 1874	" 15, 1898	10,000 00	"
" 13	August 15, 1872	Febr'y 16, 1899	10,000 00	"
" 14	" 15, 1872	" 16, 1900	10,000 00	"
" 33	March 1, 1875	March 1, 1900	10,000 00	"
" 15	August 15, 1872	Febr'y 16, 1901	10,000 00	"
" 34	March 1, 1875	March 1, 1901	10,000 00	"
" 16	August 15, 1872	Febr'y 16, 1902	10,000 00	"
" 35	June 1, 1875	June 1, 1902	10,000 00	"
" 17	August 15, 1872	Febr'y 16, 1903	10,000 00	"
" 36	June 1, 1875	June 1, 1903	10,000 00	"
" 18	August 15, 1872	Febr'y 16, 1904	9,000 00	"
" 37	June 1, 1875	June 1, 1905	10,000 00	"
" 19	August 15, 1873	Febr'y 16, 1905	10,000 00	"
" 20	" 15, 1873	" 16, 1906	10,000 00	"
" 21	" 15, 1873	" 16, 1907	10,000 00	"
" 22	" 15, 1873	" 16, 1908	10,000 00	"
" 23	" 15, 1873	" 16, 1909	10,000 00	"
" 24	Febr'y 15, 1874	" 16, 1910	10,000 00	"
" 25	April 15, 1874	April 15, 1911	10,000 00	"
" 26	" 15, 1874	" 15, 1912	10,000 00	"
" 27	" 15, 1874	" 15, 1913	20,000 00	"
			$347,000 00	

Interest Bearing Orders Outstanding.

Order.	Date of Issue	When Payable.	Amount.	Interest.
No. 2	November 1st, 1886	November 1st, 1890	$ 4,500 00	4 per cent.
No. 3	" 1st, 1886	" 1st, 1891	4,500 00	"
No. 4	" 1st, 1886	" 1st, 1892	4,500 00	"
			$13,500 00	

Source and Supply.

The continued low stage of water in the lakes and the increased demand upon the works has made it necessary to reinforce the supply from the bay by the use of river water to a greater extent than heretofore. The river valve has been opened 22 times during the year, and the length of time it was open was 58 hours and 35 minutes, against 44 hours and 23 minutes in 1888.

A very severe northeast storm on May 30th raised the water in the bay to such an extent that it entered the well at the strainer on the end of

the pipe from the top without passing through the reservoir. T
inflow carried a large amount of grass, bark and coarse debris w
was deposited on the strainer to such an extent as to entirely cut
the entrance of the water. On account of the severity of the st
the reservoir keeper was unable to reach the reservoir from the s
until the following morning, when the debris was at once removed
the supply from that source renewed. From 4 p. m. May 30th un
a. m. May 31st, the entire supply was taken from the river. Du
the evening of November 28th, the supply from the Bay was cut of
accumulation of anchor ice at the end of the pipe, and the supply
taken from the river until this accumulation was removed on the m
ing of the 29th. A severe southwesterly gale on Sunday, Decem
22d lowered the water in the bay to such an extent that the
would not supply the city, and it was necessary to take a portion
the supply from the river about 4½ hours. At 12 o'clock noon of
day the water in the river opposite the pumping station was at 3
(city datum), the lowest stage of which we had at that time any re
since permanent gauges were established. On Sunday, Decem
29th, another storm from the same direction and of equal seve
lowered the water to 35 feet (city datum) and it again became ne
sary to take a large portion of the supply from the river nearly
hours. All of the other occasions on which it has been necessar
open the river pipe, have been when there was an increased dem
upon the works for fire service. The dates and length of time the
valve has been opened during the year have been as follows:

January	1st, Fire service		20 minutes
"	6th, " "	1 hour	
"	17th, " "		35 minutes
"	26th, " "		20 "
"	29th, " "		15 "
Feb'y	7th, " "		20 "
"	20th, " "		20 "
"	24th, " "		10 "
March	29th, " "	4 hours	30 "
April	24th, " "	2 "	25 "
"	24th, " "		25 "
"	26th, " "		10 "
May	30th and 31st, Supply cut off	15 hours	
June	14th, Fire service		30 "
August	10th, " "	5 hours	
"	19th, " "	9 "	
"	31st. " "		40 "
October	16th, " "		15 "

Nov.	28th, Supply cut off	4	hours	45	minutes
"	29th, " "	3	"	55	"
Dec.	22d, Low water	4	"	20	"
"	29th, " "	4	"	20	"
		58	hours	35	minutes.

The total (estimated) quantity of water pumped from the river is 5,000,000 gallons, the total quantity pumped during the time the river pipe was open being 8,650,000 gallons.

The usual annoyance caused by the turbid condition of the water during the spring freshets was experienced last spring. From April until June the water carried a large amount of sediment, but in the last mentioned month it attained its normal condition, and there was very little cause for complaint until the heavy rains in December, which caused a large discharge from the rivers emptying into the bay; this, combined with the severe westerly winds which prevailed during that month have caused the water in the bay in the vicinity of the inlet to assume the condition usually incident only to the spring freshets, and the close of the year finds the water supply in fully as disagreeable condition, as regards roily water, as at any time during the spring months. This is unavoidable as long as the supply is taken from its present location, except by the use of an expensive filtering plant.

The desirability of changing the location of the source of supply to the west shore of the bay has been suggested in former reports of this department. The necessity for an increase in the quantity of the supply from the bay is increasing yearly; as this can only be accomplished by laying a new inlet pipe, and the cost of laying a new conduit from the pumping station to the west shore of the bay will be but little if any more than to the present inlet, with a certainty of greatly improving the quality of the supply, it is respectfully urged that definite action be taken during the present year toward the construction of a new inlet of suitable capacity, the supply to be taken from a point west of the Kawkawlin river.

Pumping Station.

At the time of submitting the last annual report of the department, tests had been made which showed a large percentage of slip in the pumps of the Gaskill engines. This was overcome early in the year by removing the water packing rings and substituting square rubber packing. Since that time repeated tests have shown that there

was practically no slip in these pumps, and in estimating the qua of water pumped, no deduction has been made from the full estim capacity of the pumps. At the time the packing was changed, b glands were procured in place of the cast iron ones which were pl in the pumps when constructed, and which were found extremely ficult to remove, one of them being broken in removal. The e cost of repairs on these engines for the year was $62.29, which incl the cost of substituting brass glands in the pumps as above stated putting in one-inch cold water connections to the condensers; having been fonnd necessary on account of the small quantity of s condensed and the consequent difficulty of adjusting the large denser valves close enough to maintain the proper temperature fo feed water to the boilers without the valves becoming clogged shutting off the cold water supply to the condensers entirely.

The high pressure exhaust pipe from the quadruplex engin the smoke stack has been renewed at a cost of $84.50, including labor employed in making the renewal. This pipe, which p through the fire room in front of the boilers, has not been in cond for use for several months, and it was hoped that its use would n again required; but on the occasion of the Nickless lumber fire, it became necessary to run both the Gaskill and quadruplex engin their full capacity, great difficulty was experienced in maintaining able steam pressure with the three boilers in use, on account of gishness of the draught; there would have been no difficulty ha been possible to turn the exhaust into the stack, and to guard ag future trouble in the same direction this pipe was at once rene although it is hoped that its use will not be required.

Some minor repairs have been required on the boilers, and a s patch has been placed on No. 2 boiler. New liners and bolts been procured for several of the fire doors, and one of the steam ga was sent to the manufacturers for general repairs. Total co repairs on boilers, including inspection fee, $67.04.

The balance of repairs on pumping machinery consists of rene of feed pipes, varnish for pumping engines, etc. The total am paid for repairs on pumping engines was $256.64.

The pumping engines are all in good condition, and capable, sufficient reliable boiler capacity, of being run to their maximum ca

ity at any time. The boilers are in about the same condition as one year ago. No. 1 and 2 boilers have been in use more than 17 years, and No. 3 15 years. None of them are in first-class condition, but No. 2 is the least reliable of any and should be replaced by a new one. From experiments made with steel and iron plates and observation and information as to the effect of impure waters upon these metals, doubts have arisen as to the advisability of using steel instead of iron in the construction of new boilers for use at the pumping station with our present water supply, and it may be thought best to run another year with the old boilers to give a better opportunity to decide this question before procuring new boilers.

The Gaskill engines have been run during the year 8,659 hours and 27 minutes, having been shut down 100 hours and 33 minutes for repairs, packing, etc. The longest continuous run of these engines was 36 days, from August 20th to September 25th.

The Holly quadruplex engines have been run 123 hours and 53 minntes, 24 hours and 5 minutes of which was with the Gaskill engines in operation, and 99 hours and 48 minutes pumping the entire city supply.

The high pressure engine and rotary pumps have been run 45 minutes, during which time they pumped the supply of the city.

Total quantity of water pumped:

By Gaskill engines.....	929,305,047	gallons
By quadruplex engines.....	15,055,755	"
By rotary pumps.....	111,945	"
	944,472,747	gallons

932,866,053 gallons were pumped against an average domestic pressure of 40 lbs. per square inch at the pressure gauge in the pumping station, which is equivalent to a lift of 108 feet from the level of the water in the wells; and 11,606,694 gallons were pumped against an average pressure of 85 16-100 lbs. at the gauge, equivalent to a lift of 217 feet from the surface level of the water. The average lift of all the water pumped was 110 4-10 feet.

The number of fire alarms received at the pumping station was 99, and the works were run under fire pressure 63 hour and 48 minutes.

The greatest quantity of water pumped in one day was 4,06 gallons August 19th; during nearly one hour of this day, the pumped at the rate of more than 8,000,000 gallons in 24 hours with the Gaskill and quadruplex engines in operation.

The least quantity of water pumped in one day was 2,187,92 lons; November 28th.

The net cost of running the pumping engines was $5,720.8 follows:

Salaries		$ 3,480 00
Fuel consumed		1,666 85
Oil, packing and supplies used		302 83
Repairs on engines and boilers		256 64
Repairs on boiler arches		14 50
		$ 5,720 82
Cost per million gallons pumped	$ 6 06	
Cost per million gallons raised 100 feet	5 49	
Cost of fuel per million gallons pumped	1 77	
Cost of fuel per million gallons raised 100 feet	1 60	

At the commencement of the year there was 990 cords of (pine slabs and edgings) piled on the yard at the pumping station paid for); the cost of this wood was 50 cents per cord on the ya this amount 15 cords were delivered at the office, and used und boiler there; the remaining 975 cords were used at the pumping st

In March proposals were received from Messrs. Folsom & A and Messrs. Dolsen, Chapin & Co., for furnishing fuel for one consumption at the pumping station.

These proposals were:

From Folsom & Arnold	50 cents per cord.
" Dolsen, Chapin & Co	35 " "

In compliance with a resolution adopted by the Board Mar 1889, a contract was entered into with Messrs. Dolsen, Chapin for about 2,500 cords of wood to be piled on the water works yard cents per cord, to be paid for monthly as consumed. Under this ment 2,379¼ cords were delivered during the season; of this a 1,365 cords were delivered in the fire-room, leaving on the yard close of the year 1,014¼ cords. The cost of delivering wood from to fire-room was 30 cents per cord, and the total number of co delivered 2,340; total cost of wood delivered in fire-room $1,6 The number of cords burned was 2,338; cost $1,666.85.

Pumping Plant.

Boilers—Three horizontal return tubular boilers 16 feet long, 5½ eet diameter of shell, with 105 tubes 2¾ inches interior diameter in ach boiler, the boilers set in separate brick arches. Area of grate sur- ace under No. 1 boiler, 27½ square feet; under No. 2 and 3 boilers, each 4 square feet. Heating surface of each boiler (½ shell 138.24 square eet; tubes 1,209.51 square feet) 1,347.75 square feet. Steam pressure arried, 65 lbs.

Engines and Pumps—One Gaskill horizontal, compound condens- ig, crank and fly-wheel pumping engine, maximum capacity 5,000,000 allons in 24 hours. One Holly quadruplex, compound condensing, rank and fly-wheel pumping engine, maximum capacity 3,000,000 gal- ons in 24 hours. One horizontal high pressure piston engine, driving hrough gears two No. 10 Holly rotary pumps, maximum capacity ,500,000 gallons in 24 hours.

Capacity of Gaskill pumps per revolution	121 gallons.
Capacity of quadruplex pumps per revolution	55 "
Capacity of rotary pumps per revolution	17 "



WATER PUMPED. 1889.

MONTH.	GASKILL ENGINES.			QUADRUPLEX ENGINES			ROTARIES.			TOTALS.		FIRE RECORD.					
	Hours Run.	Revolutions.	Gallons Pumped.	Hours Run.	Revolutions.	Gallons Pumped.	Hours Run.	Revolutions.	Gallons Pumped.	Gallons Pumped.	Daily Average.	No. Alarms.	Hours Run.	Highest Pressure.	Lowest Pressure.	Average Pressure.	Gallons Pumped.
January.....	719.42	*635,286	78,034,231	45.35	81,337	4,473,535				82,507,766	2,661,541	10	6.32	85	80	81.50	1,074,359
February.....	660.15	615,980	74,533,580	11.45	26,081	1,434,455				75,968,035	2,713,144	9	4.02	90	70	78	684,255
March.....	740.20	651,226	78,798,346	3.40	8,782	483,010				79 281,356	2,557,463	9	11.11	100	70	88	1,953,787
April	718.25	604,322	73,122,962	.50	2,026	111,430	.45	6,585	111,945	73,346,337	2,444,878	8	5.07	80	80	80	832,117
May.	735.33	631,238	76,379,798	8.27	20,668	1,136,740				77,516,538	2,500,533	5	2.05	80	80	80	344,608
June	717.10	608,500	73,628,500	2 50	7,669	421,795				74,050,295	2,468,343	6	2.46	80	80	80	466,697
July	727.34	*666,932	80,651,098	16 26	40,205	2,211,275				82,862,373	2,672,980	9	2.48	80	80	80	467,181
August	738.15	748,150	90,526,150	8.30	22,297	1,226,335				91,752,485	2,959,758	16	20.16	100	80	90	4,338,708
September	719.25	654,517	79,196,557	.35	1,582	87,010				79,283,567	2,642,786	7	1.46	80	80	80	276,485
October.....	742.03	663,921	80,334,441	2.00	5,280	290,400				80,624,841	2,600,801	9	2.05	90	80	81.50	370,744
November.....	715.50	584,977	70,782,217	4.10	10,078	554,290	.			71,336,507	2,377,884	8	3.25	80	70	90	511,346
December.....	724.55	605,927	73,317,167	19.05	47,736	2,625,480				75,942,647	2,449,763	3	1.55	80	80	80	286,407
Totals.....	8659.27	7,690,976	929,305,047	123.53	273,741	15,055,755	.45	6,585	111,945	944,472,747	2,587,597	99	63.58	100	70	85.16	11,606,694

Quantity of water pumped each year since the works commenced operations:

	Gallons.		Gallons.
1873	142,477,725	1881	944,382,043
1874	294,714,798	1882	775,642,466
1875	416,756,579	1883	773,942,702
1876	518,197,129	1884	831,867,463
1877	538,847,186	1885	836,970,046
1878	530,197,397	1886	779,761,852
1879	672,344,128	1887	827,195,009
1880	827,067,372	1888	872,990,164
		1889	944,472,747

Main Distribution.

Distributing mains have been laid during the year as follows:

A 6-inch Wyckoff main in McEwan street from Campbell street to Woodside avenue, with 1 fire hydrant.

A 6-inch Wyckoff main in Woodside avenue from McEwan street to Park avenue, with 1 fire hydrant.

A 6-inch Wyckoff main in Park avenue from Woodside avenue to Fourth avenue, with 3 fire hydrants.

A 6-inch Wyckoff main in Fourth avenue from Park avenue to Green avenue, with 2 fire hydrants.

A 6-inch Wyckoff main in Green avenue from Fourth avenue to Center avenue.

A 6-inch Wyckoff main in Center avenue from Green avenue to Trumbull street, with 3 fire hydrants,

A 6-inch Wyckoff main crossing Center avenue stone road at Park avenue.

A 6-inch Wyckoff main in Fraser street from Thirteenth street to Twelfth street, thence in alley between Saginaw street and Washington avenue to the north line of lot 6, block 133, addition of Lower Saginaw, with 1 fire hydrant.

A 6-inch Wyckoff main in Ingraham street from South Center street to McGraw avenue, with 3 fire hydrants.

A 6-inch Wyckoff main in McGraw avenue from Ingraham street to Harrison steet.

The cost of these extensions, including cost of making necessary connections with pipe before laid, was as follows:

McEwan street	$ 493 60
Woodside avenue	166 27
Park avenue	1,783 96
Fourth avenue	665 03

Green avenue	$ 398 80
Center avenue	1,578 18
Park avenue. (Crossing Center avenue)	83 48
Fraser street	174 70
Alley between Saginaw street and Washington avenue	198 48
Ingraham street	1,254 17
McGraw avenue	398 88
	$6,924 69

Two sections of 6-inch Wyckoff pipe were removed for the p of inserting branch castings; one in Thirteenth street at Fraser and one in South Center street at Ingraham street.

Length of 6-inch Wyckoff pipe taken out, 15½ feet.

Length of pipe laid:

	6-inch.	4-inch.	Total.
Cast iron. (Branches.)	35¾ ft.	.....	35¾ ft.
Wyckoff	10,675½ ft.	204 ft.	10,879½ ft.
Total	10,711¼ ft.	204 ft.	10,915¼ ft.

2 miles and 355¼ feet.

Total distributing mains in system:

	20-in.	16-in.	12-in.	10-in.	8-in.	6-in.	4-in.	3-in
Cast iron	44	1,467	9,083	8,527 ¾	2,007 1-12	1,079 1-12	795 ¾	.....
Wyckoff	.....	.....	.....	14,650 ½	18,513 2-12	78,831 10-12	21,701	319
Total	44	1,467	9,083	23,178 ¼	20,520 ¼	79,910 11-12	22,496 ¾	319

Total of cast iron	4 miles 1,883¾ feet.
Total of Wyckoff	25 miles 2,015½ feet.
Total distributing mains	29 miles 3,899 2-12 ft.

The number of stop valves put in during the year was 24 6-inch Flowers patent; fourteen 4-inch Flowers patent.

Total stop valves in use in distributing system:

	16-inch.	12-inch.	10-inch.	8-inch.	6-inch.	4-inch.	3-inch
Flowers patent	1	3	11	31	95	217	5
Galvin patent	1	2	4	1	5	45	.....
Brown patent	.....	1	.....	.....	1	.....	.....
Total	2	6	15	32	101	262	5

The five 3-inch valves are placed on large services supply sumers, but were put in at the expense of this department.

The number of fire hydrants set during the year, was 14. All Matthews patent made by R. D. Wood & Co.

Total public fire hydrants in use 229, as follows:

Holly pattern	131
Gaskill pattern	15
Matthews pattern	77
Galvin pattern	5
Brown pattern	1
	229

All of these hydrants are double discharge post hydrants with 4-inch inlet and two 2½-inch discharge. Two of the Matthews hydrants have R. D. Wood & Co.'s crane attachment for filling street sprinkler carts.

A number of petitions for extension of the main pipes were received during the year, which, owing to the limited means at the disposal of the board, could not be granted. Most of the lines of pipe asked for are very necessary, both for supplying consumers, and for fire protection. Many other petitions, for pipe lines equally necessary, would have been presented, had not the persons interested in securing them been satisfied that it was impossible for the Board to lay them at present. As long as the Board have only the revenue from consumers with which to pay operating expenses, and make extentions, it will be impossible to keep up with the demand for such extentions.

Petitions are now before the Board for action, for the following described lines of pipe:

Campbell street from Sherman to Sheridan street.
Sheridan street from Campbell street to Woodside avenue.
Fifth avenue from Trumbull street to Park avenue.
Park avenue from Center avenue to Seventh street.
McLellan street from Center avenue to Tenth street.
Lincoln avenue from Tenth to Thirteenth street.
Thirteenth street from Lincoln avenue to Sherman street.
Van Buren street from Tenth to Twenty-second street.
Monroe street from Thirteenth to Sixteenth street.
Madison avenue from Thirteenth to Sixteenth street.
Bowery from Thirteenth to Twenty-third street.

These lines cover a little more than 3 miles of pipe, and in addition thereto the following described lines of pipe are equally necessary, and there is a very urgent demand from the citizens resident on these streets that the pipes be laid therein:

Dolsen street from Water street to Woodside avenue.
Woodside avenue from Trumbull to Belinda street.
Woodside avenue from Grant to Van Buren street.
Campbell street from Sheridan to Belinda street.

Van Buren street from Woodside avenue to Tenth street.
Farragut street from Second street to Center avenue.
Sherman street from Woodside avenue to Tenth street.
Sheridan street from Second to Tenth street.
Madison avenue from Sixteenth to Twenty-second street.
Michigan avenue from Twenty-third to South Center street.

These last mentioned lines embrace about 5 miles of pipe siderable portion of which should be 8 inches in diameter.

If no other means are provided for making these extensio the surplus revenue from water rates, and the orders issued in l pumping engines are paid therefrom, it will be impossible for th to lay all of the pipes mentioned in less than 3 years. If the ci tinues its present rate of growth, many more miles of pipe demanded long before the lapse of that length of time.

The number of leaks discovered in the main pipes during t was 16, their location and character being as follows:

Date.	Location.	Size and kind.	Character.	How
Jan'y 28	Water street	10-inch Wyckoff	joint	plugged.
April 16	Alley bet Washington and Adams	6-inch "	bands burst	new pipe
" 20	Woodside avenue	6-inch "	joint	plugged.
May 28	Water street	10-inch "	joint	plugged.
Aug. 5	Center avenue	6-inch "	plug	plugged.
" 8	Alley bet Saginaw and Washington	4-inch "	joint	plugged.
" 15	Alley bet Jefferson and Madison	8-inch "	joint	plugged.
Sept. 3	Alley bet Jackson and Van Buren	4-inch "	joint	plugged.
" 11	Alley bet Saginaw and Washington	4-inch "	knot hole	plugged.
" 19	Center avenue	6-inch "	plug	plugged.
Oct. 2	Harrison street	8-inch "	bands burst	new pipe
" 3	Thirty-seventh and Ingraham	4-inch "	joint	new thin
" 11	Water street	6-inch "	shaky pipe	new pipe
" 25	Water street	6-inch "	joint	plugged.
" 25	Water street	10-inch "	knot hole	plugged.
Nov. 11	Trumbull street and Center avenue	4-inch "	joint	new pipe

The cost of repairing these leaks was: for labor, $56.50; terial, $24.21; total, $80.71.

It has been necessary to raise the grade of three main p make way for sewers at a cost for labor of $15.50, and for m $3.47; total, $18.97.

During the months of January and February, 4 hydrant found frozen; they were discovered by the inspector and placed in condition for use. No delays have occurred to the f partment during the year on account of defects in the fire hy Besides the examination for frozen hydrants, all of the fire hy have been gone over carefully twice during the year, and such

not in perfect order were made so, at the same time all of the main pipes were thoroughly flushed.

Five valves in street mains have been found leaking and repaired. Seventeen of the old wooden valve boxes have been found badly decayed and have been renewed, six being replaced with cast iron extension boxes, and the balance with wood. All new valves set were covered with cast iron boxes.

The total cost of repairs on main pipes, valves and fire hydrants, including inspector's time on examination, was $270.89.

Water Meters.

The number of water meters put in during the year was 41, and the number taken out 10; making net increase 31. Total number of meters and motor indicators in use, 249.

Meters set:

	2-in.	1½-in.	1-in.	¾-in.	⅝-in.	½-in.	Total.
Union Rotary	1	3	1	.....	.....	.....	5
Union Duplex	.....	.....	.....	.....	4	.....	4
Crown	.....	.....	2	1	.....	.....	3
Empire	.....	.....	.....	5	.....	1	6
Worthington	.....	.....	.....	.....	6	.....	6
Hersey	.....	.....	1	.....	16	.....	17
Total	1	3	4	6	26	1	41

Meters taken out:

	2-inch.	¾-inch.	⅝-inch.	½-inch.	Total.
Union Rotary	2	1	.....	.....	3
Union Duplex	.....	.....	1	.....	1
Crown	.....	4	.....	.....	4
Empire	.....	.....	.....	1	1
Worthington	1	.....	.....	.....	1
Total	3	5	1	1	10

Meters in use December 31st, 1889:

	8-in.	4-in.	3-in.	2-in.	1½-in	1-in.	¾-in.	⅝-in.	½-in.	⅜-in.	Total.
Union Rotary	1	5	18	5	4	3	.....	1	.....	.....	37
Union Duplex	.....	.....	.....	.....	.....	.....	.....	21	.....	.....	21
Crown	.....	.....	.....	.....	1	23	30	.....	28	1	83
Empire	.....	.....	.....	.....	.....	6	33	.....	22	.....	61
Worthington	.....	.....	.....	4	6	.....	.....	10	.....	.....	20
Hersey	.....	.....	.....	.....	.....	2	5	17	.....	.....	24
Total	1	5	18	9	11	34	68	49	50	1	246

Motor indicators 3

Eighty-two meters and the three motor indicators are clas
manufacturing, the water being used mainly for power or for s
ing steam boilers or other uses in connection with manufacturing
lishments; 154 are classed as domestic, and 10 are test meters
on private mains supplying several consumers or other tempora
no accounts being made from their readings.

Of the meters taken out, 2 were removed on account of the
water having been permanently abandoned on the premises,
were replaced by others, the size or make of meter before in us
being the best adapted to the uses of water supplied.

Three meters have been injured by frost; two of them sl
and easily repaired; one, a 2-inch Worthington, was sent to the
facturers and required expensive repairs. Besides the frozen
above mentioned, 22 have required minor repairs, generally in th
istering gear; 6 have been found leaking in the connections j
the meter to the pipes; 41 were found not registering, the piston
clogged with small pieces of wood or other matter.

In March all of the small meters which had been in use
years and which could be readily removed, were taken out, brou
the shop and given a thorough cleaning. They were also tested
their accuracy. Of 59 Crown meters tested, varying in size f
inch to 1 inch, and which had been in use from 3 to 4½ years, 16
tered 100 per cent.; the average of the 59 was 92⅓ per cent., th
est being 75 per cent. Of 14 Empire meters tested, of the same
but in use only from 2 to 3½ years, 9 registered 100 per cent., a
average of the 14 was 97½ per cent., the lowest being 85 per cen

The whole quantity of water passed through meters durin
year was 96,795,380 gallons; an increase of 3,554,485 gallons
1888. This small percentage of increase is due mainly to the im
condition of the meters; but, notwithstanding the fact that wi
water supply the expense of maintaining meters will be heavy
being constantly demonstrated that the system of supply th
meters is the equitable one, and the only practical one by
the undue waste of water can be controlled. A few cases
have occurred during the year in which water closets local
dwellings supplied through meters have been permitted to get o
order and allow a constant flow of water through them, remain
this condition sometimes for weeks, have demonstrated the capa

these fixtures to waste water, and is convincing proof that it would be a measure of true economy to place meters on every service through which this class of fixtures is supplied. A number of serious underground leaks have also been discovered through the agency of meters which otherwise would doubtless have gone undiscovered for months and perhaps years.

Services.

The number of new service connections made with the main pipes during the year was 85, and the number taken out was 2; leaving the whole number of service connections with main pipes at the close of the year, 1546.

Service connections put in:

	1-inch.	¾-inch.	⅝-inch	½-inch.	Total.
Cast iron mains	2	.....	1	2	5
Wyckoff mains	12	12	30	26	80
Total	14	12	31	28	85

Service connections taken out:

	¾-inch.	½-inch.	Total.
Wyckoff mains	1	1	2

Total service connections in main pipes December 31st, 1889:

	BRANCHES.					CORPORATIONS.							
	8-in	6-in	4-in	3-in	2-in	2-in	1¼-in	1-in	¾-in	⅝-in	½-in	⅜-in	Total.
Cast iron mains	....	2	9	....	....	2	6	46	58	34	87	5	249
Wyckoff mains	1	3	12	1	1	13	.....	164	416	239	447	.....	1,297
Total	1	5	21	1	1	15	6	210	474	273	534	5	1,546

29 branch castings and 1,517 corporation cocks.

The number of these service connections temporarily abandoned and shut off at the main pipe, but which may be renewed, is 76; leaving number open 1,470.

The number of separate service pipes supplied through the 85 new service connections put in is 91, and the number of new branch services connected with services put in in previous years is 11. The number of services before reported in use and abandoned during the

year was 8. Whole number of separate services now connected, 1,
Number of services open, 1,279. Number of services shut off at
cock, 307.

The number of services shut off during the year by employe
the Board was 233; of which 55 were closed at the request of the ow
or occupant; 89 by reason of the premises being found vacant; 2
leaks, and 63 for non-payment of rates. The number of ser
opened during the year by employees of the Board was 295.

Of the 307 services shut off at the close of the year, 17 are dw
ings or business blocks in course of construction and not comple
13 are services through which the premises to which they lead rec
only a portion of their supply, these places receiving their present
ply from other services; 54 are services leading to vacant lots, som
which are used during the summer season for pasturing stock,
most of which are vacant by reason of the buildings having bee
moved in contemplation of the erection of more extensive structu
the construction of which has not been commenced.

In concluding this report, which marks the termination of eigh
years of continuous service in this position, I beg leave to present
sincere thanks to your honorable board for the uninterrupted cou
and kindness which has been extended to me personally and offici
also to the several officials in the other departments of the city gov
ment, especially to Chief Engineer T. K. Harding and the officers
members of the fire department (the operations of which are so in
ately connected with this department), whose hearty co-operation i
matters pertaining to the welfare and most efficient working of
department have been unceasing. I also take pleasue in calling at
tion to the manner in which the several officers and employes of
department have performed their duties; it is through their pro
efficient and intelligent action that the works maintain their efficie

All of which is respectfully subimtted,

E. L. DUNBAR,
Superintendent and Secretar

Bay City, Mich., Feb'y 5th, 1890.

Summary of Statistics.

REPORT OF 1889.

Water Works of Bay City, Bay County, Michigan.

Date of construction, 1872.

By whom owned, Bay City.

Source of supply, Saginaw Bay, an arm of Lake Huron.

Mode of supply, direct pumping.

PUMPING.

1. Builders of pumping machinery, Holly Manufacturing, Co. Lockport, N. Y.
2. Kind of fuel, pine slabs and edgings.
3. Fuel consumed for the year, 2,338 cords—cost $1,666.85, average 71 3-10 cents per cord. Equal to soft coal, 1,328,000 lbs.
6. Total pumped in gallons, 944,472,747.
8. Average dynamic head, 110.4 feet.
9. Number of gallons pumped per lb. coal, 711.
10. Duty = $\frac{944,472,747 \times 8.34 \times 100 \times 110.4}{1,328,000} = 65,851,973.$

Cost of pumping, figured on pumping station expenses, $5,720.82.

11. Per million gallons pumped, $6.06.
12. Per million gallons raised one foot, $0.055.

Cost of pumping figured on total maintenance, including interest paid by city, $39,060.11.

13. Per million gallons pumped, $41.35
14. Per million gallons raised one foot high, $0.37.

CONSUMPTION.

1. Estimated population to date, 35,000.
2. Estimated population on lines of pipe, 17,500.
3. Estimated population supplied, 12,000.
4. Total gallons consumed, 944,472,747.
5. Passed through domestic meters, 32,779,882 gallons, 3½ per cent.
6. Passed through manufacturing meters, 64,015,498 gallons, 7 per cent.
7. Average daily consumption, 2,587,597 gallons.
8. Gallons per day to each inhabitant, 74.
9. Gallons per day to each consumer, 216.
10. Gallons per day to each service (distribution 22) 1,760.

DISTRIBUTION.

1. Material, cast iron and Wyckoff.
2. Sizes, 3-inch to 20-inch.
3. Extended, 10,915¼ feet.
4. Abandonded, 15½ feet.
5. Total in use, 29¾ miles.
6. Cost of repairs, $9.76 per mile.
7. Leaks per mile, 5-10.
8. Small distribution less than 4-inch, 319 feet.
9. Hydrants added, 14.
10. Number in use, 229.
11. Stop gates added, 24.
12. Number in use, 423.
13. Number of small gates less than 4-inch, 5.
14. Number of blow-off gates, 21.
15. Range of pressure at center day and night, 27 to 34 lbs.

SERVICES.

16. Material, lead, wrought iron and Wyckoff.
17. Sizes, ¾-inch to 8-inch.
21. Service taps added, 83.
22. Number in use, ~~1949~~ 1970
25. Meters added, 31.
26. Number in use, 246. Domestic, 154; manufacturing, 82; test, 10;
27. Motors and elevators added, 7.
28. Number in use, 23.

Financial—Maintenance.

RECEIPTS—DIVISION I.			EXPENDITURES.		
A.—Water rates, domestic	$16,518 53		A. A.—Management and repairs, except interest	$ 9,780 11	
B.—Water rates, manufacturing	5,701 87		B. B.—Interest on bonds, paid by tax levy	28,560 00	
C.—Net receipts from water		$22,220 40	Interest paid by water works	720 00	
D.—Miscellaneous, service connections, rents, etc.		555 25	C. C.—Total maintenance for year		$39,060 11
E.—Total		$22,775 65	Bonds paid by tax levy		10,500 00
From public funds—			Bills payable paid by water works		4,500 00
J.—Tax levy for interest	28,560 00		D. D.—Balance to construction		7,775 54
Tax levy for bonds	10,500 00				$61,835 65
		39,060 00			
		$61,835 65			
DIVISION II.					
From fixed rates—					
L.—Domestic	$13 258 47				
M.—Manufacturing	537 77				
N.—Total		$13,796 24			
From meter rates—					
O.—Domestic	3,260 06				
P.—Manufacturing	5,164 10				
Q.—Total		8,424 16			

Construction.

R.—From balance of previous years		$ 6,552 11	F. F.—Extension of mains	$ 6,924 69	
From balance of maintenance		7,775 54	H. H.—Water meters	580 72	
		$14,327 65	I. I.—Total for construction		7,505 41
			J. J.—Balance		6,822 24
					$14,327 65

W.—Net cost of works to date	$ 447,583 76
X.—Bonded debt, city bonds	347,500 00
Bills payable	13,500 00

Report of Accountant on Books of 1888.

To the Honorable Board of Water Commissioners of the city of Bay City:

GENTLEMEN—The undersigned, an accountant employed to audit the books and accounts of the Bay City Water Works for the year 1888, would submit the following report:

I have examined the records, vouchers, accounts and books of the Secretary, also the several statements as shown in the Superintendent's printed report, as follows:

Folio 5, cash collections; folios 5 and 6 show amounts deposited with City Treasurer and placed to the credit of the water works fund, and dates of the same. Folio 6, total receipts of the Board from all sources since the year 1871, also total collections from water rates for the same time. Folios 7, 8, 9, 10 show expenditures in detail for the fiscal year ending December 31st, 1888. Folios 11 and 12 show the account with water works fund and the Treasurer of the Board, and statement of monthly pay rolls for the year 1888. Folios 12 and 13, ledger balances for the year 1888. Folios 13 and 14, balances of all accounts from the commencement of the construction of the works to December 31st, 1888.

I have also examined all assessment rolls and compared the same with stubs of receipts and found them to agree perfectly with each other, and the daily record of the same.

All of which is respectfully submitted.

(Signed) DANIEL A. MARSHALL.

Bay City, March 15th, 1889.

Materal used in running pumping engines, for 1889:

	COST.
2,338 cords of wood	$ 1,666 85
146 2-10 gallons of cylinder oil	90 07
27 lbs. lubricant	4 76
11¼ lbs. "Eureka" packing	6 68
2 lbs. cotton packing	80
20 lbs. hemp packing	4 60
2 lbs. ⅝-inch square rubber packing	76
66 lbs. 1-inch square rubber packing	26 25
11½ lbs. "Usudurian" packing	8 05
5 lbs. sheet rubber	2 90
3 lbs. boiler gaskets	1 35
1 lb. wicking	40
15½ lbs. leather	4 96
20 lbs. rivets	2 00
50 bolts	1 00
5 lbs. plumbago	1 25
1 lb. red lead	10
Tripoli, rottenstone and acid	77
715½ lbs. wipers	38 72
Concentrated lye	56
½ doz. brooms	1 65
Emery cloth	1 00
1 gallon lard oil	75
476 gallons kerosene oil	42 50
2 4-12 doz. lamp chimnies	1 30
Lamp wicks and matches	75
325 lbs. boiler compound	27 17
32 bars soap	1 20
Air pump valve	3 20
Sheet brass and copper	50
Files, oilers, etc	4 20
Gauge glasses	50
Ice	11 15
	$ 1,929 68

On hand December 31st, 1889:

	COST.
8 cords wood	$ 5 20
21 gallons cylinder oil	9 45
6 gallons cylinder oil	3 78
23 lbs. lubricant	2 87
10 lbs. cotton packing	3 00
33 lbs. hemp packing	6 60
4 lbs. ⅝-inch square rubber packing	1 52
6 lbs. sheet rubber	3 48
9 lbs. "Heston" packing	13 50
13 lbs. boiler gaskets	7 15
8 lbs. "Goodsell" packing	12 00
1 lb. wicking	40
200 lbs. boiler compound	16 00
209 lbs. wipers	11 50
5 lbs. tripoli	50

1 lb. rotten stone	15
¼ lb. oxalic aid	06
3 boxes concentrated lye	37
½ doz. brooms	1 62
81 bars soap	2 92
4 lbs. leather	1 28
5 gallons kerosene oil	45
49 lamp chimnies	2 45
1 gauge glass	25
102 boxes matches	1 42
Oilers, tools, steam hose, etc	30 89
	$138 81

Uses supplied at fixed or schedule rates:

3 Bakeries.	352 Hose for Sprinkling.
3 Banks.	30 Hotels.
12 Barber shops.	1 Labratory.
4 Bath rooms (public.)	5 Laundries.
1 Bath room (Turkish.)	2 Machine shops.
206 Baths (private.)	28 Offices.
5 Blacksmith shops.	1 Paint shop.
6 Boilers (for power.)	1 Passenger depot.
8 Bottling works.	4 Photograph galleries.
10 Boarding houses.	3 Plumber shops.
21 Business blocks (not classified.)	1 Postoffice.
1 Business college.	1 Printing office.
8 Butcher shops.	2 Refrigerators.
2 Carriage shops.	8 Restaurants.
1 Cemetery.	57 Saloons.
1 Chapel.	1 Salt crusher.
3 Churches.	12 School buildings (public.)
2 Cigar factories.	2 Soap factories.
2 Clothes cleaning.	8 Stables (livery.)
1 Cooper shop.	7 Stables (mill.)
1 Cracker factory.	159 Stables (private.)
1 Creamery.	1 Stable (sale.)
705 Dwellings.	1 Stone yard.
1 Express office.	94 Stores.
92 Families in blocks.	2 Tailor shops.
2 Fire pipes.	2 Telegraph offices.
1 Fish market.	1 Telephone exchange.
2 Fountains.	1 Undertaker.
1 Gas works.	638 Water closets.
4 Gas engines.	60 Water closets in schools.
2 Gun shops.	7 Water motors.
6 Halls (public.)	1 Wood yard.
2 Harness shops.	2 Warehouses.

Uses supplied through meters:

2 Bakeries.	2 Laundries.
2 Barber shops.	1 Lodging house.
1 Bath room (public.)	5 Machine shops.
52 Baths (private.)	15 Offices.
1 Boarding house.	1 Opera house.
31 Boilers (for power.)	2 Passenger depots.

1 Boiler shop.
3 Bottling works.
5 Box fractories.
1 Brewery.
14 Business blocks (not classified.)
1 Carriage factory.
4 Churches.
1 Club room.
1 Coal and wood yard.
1 Cooper shop.
1 County court house.
1 County jail.
1 Creamery.
9 Drill houses.
127 Dwellings.
1 Electric light works.
1 Elevator.
2 Flour mills.
3 Foundries.
1 Fountain.
1 Furniture factory.
1 Gas engine.
2 Green houses.
61 Hose for sprinkling.
1 Hospital.
16 Hotels.
1 Hall (public.)
1 Pipe works.
7 Planing mills.
1 Plough works.
2 Printing offices.
1 Railroad office.
1 Railroad round house.
1 Reel factory.
1 Restaurant.
6 Saloons.
15 Salt blocks.
16 Saw mills.
1 Sash and blind factory.
1 School.
1 Soap factory.
2 Stables (hotel.)
6 Stables (livery.)
8 Stables (mill.)
1 Stable (omnibus.)
27 Stables (private.)
2 Stables (street car.)
14 Stores.
190 Water closets.
13 Water motors.
1 Wooden ware works.
21 Pipes on which hydrants or ho
nections are placed for fire pro

Uses shut off:

1 Ashery.
1 Bank.
1 Barber shop.
5 Baths (private.)
6 Blacksmith shops.
4 Boarding houses.
1 Boat dock.
1 Box factory.
2 Butcher shops.
6 Business blocks (not classified.)
1 Cigar factory.
3 Drill houses.
115 Dwellings.
2 Elevators.
1 Foundry.
34 Hose for sprinkling.
4 Hotels.
6 Hydrants for fire protection.
1 Kindling factory.
1 Machine shop.
1 Market garden.
2 Offices.
1 Photograph gallery.
1 Rink (roller.)
3 Saloons.
2 Salt blocks.
1 Saw mill.
1 School building.
1 Shingle mill.
7 Stables.
40 Stores.
54 Vacant lots.
6 Vacant buildings.
24 Water closets.
1 Warehouse.

City uses (no payment):

1 City building occupied by police station and city offices.
1 City building occupied by library and city offices.
6 City hose and truck houses.
15 Water closets in city buildings.
1 City electric light works.
8 Public watering troughs.
2 Ornamental fountains in public squares.
10 Hose for sprinkling parks.
229 Public fire hydrants.

NINETEENTH

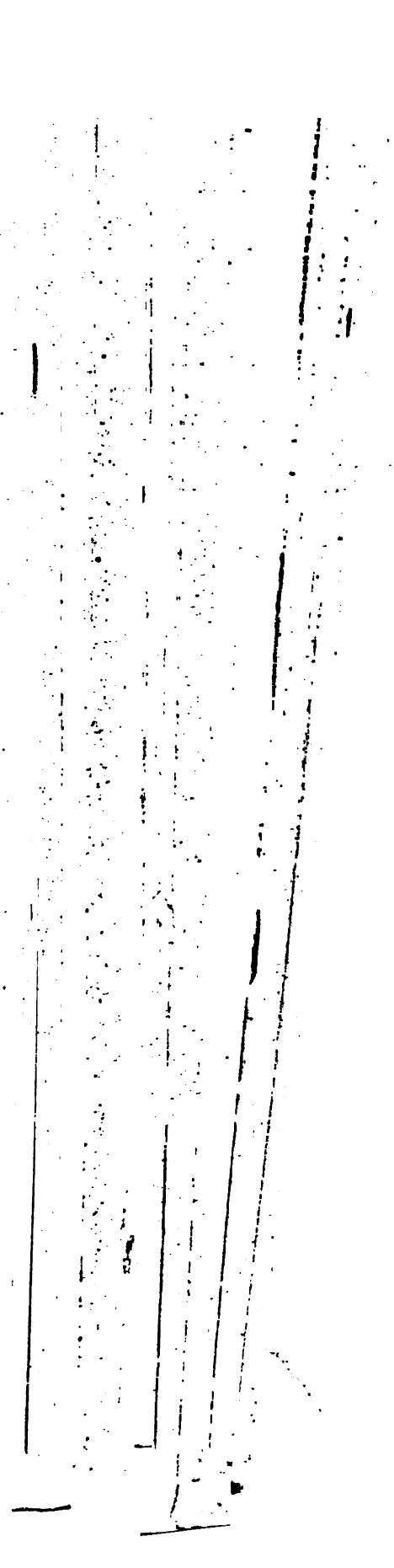
Annual Report

—OF THE—

Superintendent of Water Works.

Bay City, Michigan.

1890.



NINETEENTH

Annual Report

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Bay City, Michigan.

1890.



BAY CITY, MICHIGAN.

Water Department.

1890.

COMMISSIONERS.

ANDREW WALTON, PRESIDENT.
(Term expires Sept. 6, 1894.)

G. HENRY SHEARER.
(Term expires Sept. 6th, 1895.)

BENJAMIN F. RAY.
(Term expires Sept. 6th, 1896.)

SELWYN EDDY.
(Term expires Sept. 6th, 1897.)

LOUIS MORITZ.
(Term expires Sept. 6th, 1891.)

DUNCAN McGREGOR.
(Term expires Sept. 6th, 1892.)

FREMONT J. TROMBLEY.
(Term expires Sept. 6, 1893.)

Superintendent and Secretary.....E. L. DUNBAR.
Office Assistant.....T. A. DELZELL.
Inspector.....FRANK H. COLLINS.
Reservoir Keeper.....LEVI D. CARPENTER.

First Engineer.....A. B. VERITY.
Second Engineer.....NEWTON P. SMITH.
Fireman.....A. J. CARPENTER.
Fireman.....PATRICK O'HARE.

SUPERINTENDENT'S REPORT.

To the Honorable Board of Water Commissioners of Bay Ctty, Michigan:

GENTLEMEN—I beg leave to submit herewith the Nineteenth Annual Report of the Water Works Department of the city, showing the operations of said department for the year ending December 31st, 1890.

The term of office of Commissioner John D. McKinnon expired on the 6th day of September, 1890, and that of Commissioner Geo. C. Myers on the 4th day of August, 1890. At a regular session of the Common Council held September 8th, 1890, the Mayor presented the name of Selwyn Eddy to succeed Mr. McKinnon for the term of seven years from September 6th, 1890, and that of Fremont J. Trombley to succeed Mr. Myers for the term of two years from September 6th, 1890. These nominations were confirmed by the Common Council at the same session, and the gentlemen named qualified and became members of the Board.

The quality of the supply from the city water works system has been severely criticised, and the large number of cases of typhoid fever which occurred during the summer and fall were attributed by some to the use of water from the water works. A considerable number of these cases were in families taking their water from one particular hydrant located near the pumping station. A careful investigation of the matter and an analysis of the water from this hydrant, made by the Health Department, appeared to place the matter beyond doubt that these cases were caused by the impurity of the water; but careful investigation in other portions of the city and

analyses of water taken from other hydrants, both made by th same authority, failed to show any cause for alarm. Most of th cases outside of the locality mentioned above, were in familie obtaining their supply of water from wells and cisterns, and locate entirely away from the pipe lines of the water works system. What ever responsibility rested upon the city water supply for the prevalenc of the disease, must have been due entirely to the introduction of rive water into the pipes. Repeated analyses have shown that the rive water is unsafe for domestic use, but analyses of the water from th bay indicate no impurities of a dangerous character. The large deman upon the works during the months of July, August and Septembe together with the prevailing low water in the bay, rendered it neces sary to take a portion of the supply from the river during a considerabl portion of the time. In the three months mentioned there were twenty days in which it was necessary to take part of the supply from the rive for domestic use, not including the time it was necessary to use th river supply to help out in case of fire. There were several days o which it was necessary to keep the river supply partially open from a. m. until 6 p. m., the demand upon the works being too great durin all of these hours for the pipe from the bay to supply. That this con tinued and repeated use of water from the river is fraught with dange to the health of the city is beyond dispute, and it is earnestly urge that steps be taken to increase the supply from the bay by the construc tion of a larger inlet pipe; and the recommendations in former report is repeated, that the location of the intake be changed to the west shor of the bay, where a supply of greater purity can be obtained withou any increase in the cost of construction. In the meantime the deman can be brought within the capacity of the present inlet (except in cas of a large fire, or obstructions by anchor ice) by cutting off all larg unnecessary and wasteful uses of water, and a general metering of al premises where water closets and similar fixtures are permitted to ru when not in use.

The demand upon the works for fire service has been greater tha ever before since the works have been in operation. The pumping engines have met these demands with ease, but the boiler capacity ha been taxed, at times, to its full limit, especially, as often happens when the fuel was not in first-class condition, and there is, at the same time, an unusually heavy demand upon the works for fire service. The

greatest difficulty, however, has been experienced from the want of capacity in the lines of pipe to deliver in a large portion of the city the quantity of water required for the fire service. The large increase in the manufacturing and business interests of the city, call for increased facilities for fighting fire. The fire of April 15th, by which nearly the entire plant of Bousfield & Co., in the extreme southern portion of the city, was wiped out, demonstrated that the fire service in that end of the city was not as good as the interests of that part of the city demanded. Nine streams were thrown at one time at this fire, and while they were not up to the standard of good, efficient fire streams, they were a long way from being the miserable failure which some of the spectators endeavored to make out. Two of the streams made a poor exhibit by reason of the hydrant to which they were attached being broken dnring the fire. This hydrant was broken while being closed to detach a length of burst hose, and in such a manner as to render it impossible to open it to more than one-quarter of its full capacity, but as the next nearest hydrant not in use was about 1,000 feet away from the fire, it was thought best to continue it in service in its crippled condition.

The investigation ordered by the Common Council immediately after this fire, resulted in several joint meetings of the special committee of the Common Council, the Fire Commission and the Water Board. As a result of these meetings, the following report and recommendation was submitted to the Common Council May 5, 1890: (That portion of the report relating to the fire alarm system and the purchase of hose is omitted.)

"The question of water supply was considered, and it was clearly shown that the present system of main pipes was totally inadequate to supply the quantity of water necessary to cope with such fires as have recently taken place in the southern portion of the city. Owing to the limited means at the disposal of the Water Board, and their efforts to supply some measure of fire protection to all portions of the city, as far as possible, even if such protection were not as complete as was desirable, smaller pipes have been placed in many streets than would otherwise have been used. The growth of the city and its manufacturing industries have caused a demand for a supply of water for fire protection which the pipes as originally laid, with the small additions which the Water Board have been able to make with their surplus revenue, are totally inadequate to supply. It is therefore recommended and earnestly urged that immediate steps be taken to secure an in-

creased supply of water to the southern portion of the city, an accomplish this result the following lines of pipe, recommended b Water Board, should be laid as soon as possible: The 6-inch pi South Center street should be replaced by a 10-inch pipe as far e Jennison avenue. The 6-inch pipe in Twenty-third street shou replaced by a 10-inch pipe, at least as far east as Bowery. A ne inch main should be laid from Tenth street to South Center stre or near the line of Bowery. An 8-inch pipe should be laid in street, from Fremont avenne to South Center street. An 8-inch should be laid in South Center street, River street and Bullock from the corner of South Center and Harrison streets to the corn Bullock road and Harrison street.

"The estimated cost of the extensions is $25,000. In additi the above described lines of pipe, there should be laid, for the b of the entire city, a large main pipe from the pumping station to S Center street, passing through the business center of the city, in or Washington avenue, such main pipe to be 20 inches in diameter south as Tenth street, thence 16 inches in diameter to Twenty- street, and thence 12 inches in diameter to South Center street.

"The estimated cost of this large main pipe from the pumping tion to South Center street is $70,000. As no possible provision c made for issuing the bonds of the city to provide means for l these pipes until the general election in November next, and seems impracticable to commence the large main pipes except means provided in that way, your committee recommend that the tion of issuing $100,000 in bonds (the proceeds of said bonds t used for defraying the expense of laying the pipes above menti and such other pipes as the Water Board may deem necessary), be mitted to the electors of Bay City; $50,000 to be voted upon at November election, and $50,000 at the election in April, 1891, as vided in section 77 of the city charter, and inasmuch as there exist most urgent necessity for such measure of relief to the southern po of the city as can be accorded them, we recommend that the W Board proceed at once to lay the pipes mentioned in the first porti the above estimate, the cost of which amounts to $25,000, and fo purpose of defraying the expense of laying said pipes without inte ing with other payments to which the Water Board are obligated, laying certain other lines of pipe which the Board deem necessary recommend that $—— be transferred from the liquor monies (so-ca to the water works fund, and for the balance of the $25,000 requ the Water Board be authorized by resolution to incur an indebted and issue orders drawing interest at 4 per cent. per annum, pay within one year from their date, for the sum of $——, such indeb ness to be incurred only for the purpose of defraying the balance o expense of laying the pipes mentioned.

"If the electors shall authorize the issuing of the bonds as above provided, the proceeds of said bonds to be used:

"First. For paying the money into the city treasury transferred from the liquor fund and paying the indebtedness incurred by the Board as authorized.

"Second. For laying the main pipe from the pumping station to South Center street.

"If the electors shall refuse to authorize the issue of bonds, the indebtedness incurred by the Water Board during the present season to be paid by monies transferred from the liquor fund of 1891, or by tax levy on the assessment roll of 1891."

This report was received, ordered published with the proceedings and made the special order for the next meeting. At the session of the Common Council held May 12th, the report of the special committee, as given above in full, was adopted, and $10,000 were ordered transferred from the liquor fund to the water works fund, and the Board of Water Works were authorized to incur an indebtedness of $15,000 for laying the pipes mentioned in the report as within the power of the Board to lay, previous to issuing the bonds of the city.

The work of laying these pipes was commenced within three days after the adoption of the report, and was pushed as rapidly as material could be procured, but owing to delays in the delivery of pipe, the work was not completed until October. The result has been a very material increase in the pressure in the south part of the city, especially when a large number of fire streams are in service.

In order to carry out the recommendation of the report as regarded the provision for laying the large main, the electors were called upon to vote at the general election held November 4th, 1890, upon the question of issuing $50,000 in bonds; the proceeds of said bonds to be used in improving and extending the water works system. The bonds to be issued bearing date May 1st, 1891, payable $25,000 in 15 years and $25,000 in 20 years from that date. The question was carried in the affirmative by a vote of 1,495 yeas to 471 nays.

To carry out the recommendation in full, it will be necessary to call upon the electors to vote at the spring election upon the question of issuing the other $50,000 of bonds. If this vote carries, it will provide ample means for completing the large main to South Center street, besides repaying the money borrowed from the liquor fund, and paying the indebtedness incurred by the board, amounting to $11,629.73.

Should the electors fail to vote the remaining $50,000, there sufficient sum now provided to pay the indebtedness mentioned lay the 20-inch main as far as Center avenue. The location of pipe should be determined and contracts let as soon as possible fo pipe as far as the means now available will complete it, as cont for iron pipe can be let to much better advantage and for earlier d ery now than in the spring.

Nearly all of the extensions of the main pipes made durin year have been in the direction of improving the service to the end of the city, and but little has been done to relieve the wan those residing in that part of the city between Second and Tw streets, where there are a number of streets well built up with a class of residences, with no water supply; neither has anything done to afford fire protection to that portion of the city lying bet Fitzhugh street on the west and Sherman street on the east, and tween Thirteenth and Twenty-second street; this tract, nearly t fourths of a mile square, is becoming very thickly settled, and ha pipes within its limits, depending entirely for its fire protection the fire hydrants surrounding it on the streets mentioned.

Petitions are now before the Board for lines of pipe in the fo ing named streets:

Campbell street, from Sherman to Sheridan streets.
Sheridan street, from Campbell street to Woodside avenue.
Fourth avenue, from Trumbull street to Park avenue.
Fifth avenue, from Trumbull street to Park avenue.
Park avenue, from Center avenue to Ridge Road.
Sherman street, from Center avenue south.
Lincoln avenue, from Tenth to Thirteenth street.
Van Buren street, from Thirteenth to Twenty-second street.
Jackson street, from Tenth to Eleventh street.
Monroe street, from Thirteenth to Sixteenth street.
Madison avenue, from Thirteenth to Twenty-second street.
Thirteenth street, from Sherman street to Lincoln avenue.

Besides the above described lines of pipe, all of which are needed, the following named streets should be piped at as early as possible; some of them are quite as much in need of the pipes a of those named above:

Campbell street, from Belinda to Sheridan street.
Farragut street, from Second street to Center avenue.
Sherman street, from Woodside avenue to Center avenue.
Sheridan street, from Second to Tenth street.
Michigan avenue, from Twenty-fifth street to Fremont avenue.

If the additional $50,000 is voted in April, considerable can be done this year towards the above mentioned lines of pipe, besides laying the large main contemplated.

Insurance was placed in December on the boilers in the pumping station with the Hartford Steam Boiler Inspection and Insurance Company. The Inspectors' report indicates that the boilers are in fair condition, and good for some years yet at the pressure carried, but the Insurance Company advises the placing of two more boilers in the works. In view of the fact that the boilers are in better condition than was supposed, and that the demand upon the works is now so great that it would be very unsafe to have one of the boilers out of service a sufficient length of time to take it out and replace it with a new one (instead of putting in new boilers in place of the old ones, changing one at a time, as has been hitherto advised), it would be the better plan to build an addition to the boiler room and put in two new boilers constructed to carry heavier steam pressure than is safe on the old ones. The fact that we can carry only 75 pounds pressure on the boilers works against the most efficient operation of the pumping engines for fire service; neither are the three boilers sufficient to furnish steam to run all of the pumping engines to their full capacity should their use be required. It is, therefore, recommended that plans be procured for the necessary addition to the boiler room, with a view to placing two new boilers therein; the boilers to be the same size as those now in use, but built to carry 100 pounds of steam with safety. The plans of building to be preparatory to an estimate of the cost of the entire improvement contemplated.

The meter system has been extended but very little during the year, and has not kept up with the increase in services, as an increase of 44 million gallons in the quantity of water pumped would indicate. The total quantity of water pumped during the year was 988,771,453 gallons, of which 106,965,627 gallons was supplied through meters. Assuming that 25 per cent. of the water pumped was used for public purposes, flushing pipes and sewers, public watering troughs, parks, fountains, fire department use, etc. —and this appears a liberal estimate —would leave 634,612,963 as the quantity passed through unmetered services. The meters so far put in have, of course, been placed on those services where the largest quantity of water was used; the 172 meters classed as domestic including all of the large hotels, many business

blocks and the larger class of dwellings. The total quantity of wat supplied through the 172 domestic meters was 35,779,852 gallons, an average of a trifle over 200,000 gallons to each of these services.

The *legitimate* uses of water through the unmetered services w not average 50 per cent. of this amount, but assuming the *same* avera the use of water through the unmetered services would be less th 300 million gallons, showing that more than one-third of all the wat pumped is wasted. If one-half of this waste can be stopped, it w obviate the necessity for turning on the supply from the river exce under very extraordinary circumstances, besides materially improvi the service throughout the city, and reducing the wear and tear on t pumping machinery.

Objections have been raised to the metering of domestic servic on the ground that the use of water would thereby be restricted b yond what is necessary for keeping water closets and sewers in healthy condition, many consumers insisting that a constant flow water is necessary to keep this class of fixtures in good order. T same objection was raised in Detroit, where the city has recently co menced applying the meter system, and Secretary Case, of the Detr Water Board, addressed a communication to the editor of "The Wat and Gas Review," asking his opinion on this question.

In the December number of that journal, after quoting Mr. Cas letter, the editor replies as follows:

"Mr. Case's letter refers to a matter which has been before t public of every municipality where meters have been introduced efforts been made to curtail the waste of water, and it is only natu that those who have a mere superficial knowledge of the subject, a who do not have the opportunity to consider it from an intellige point of view, should be misled by erroneous ideas. We believe th the question does not require much of a clear, concise and logical d cussion. A simple statement of the facts as they exist, and as th have been proven to exist, is all that is necessary.

"The waste, so large a factor in water consumption everywhe running into waste pipes and sewers, has no effect whatever in removi deposits of solid matter which accumulate in them. This is proven the fact that in many large cities where the water consumption greatest, it is necessary at frequent intervals during the year to flu the sewers for the purpose of removing the accumulation of matt which gathers there.

"In the management of cities no more important matter can be co templated than the health of the people, and questions as to t

efficiency of the sewerage system properly receive a large amount of serious consideration. The liquid matter in sewers is easily disposed of, but the solid and greasy matters are deposited in the sides and bottom of the conduits, and if they were not removed, they would gradually fill up the sewers by a continuous deposit, just as river beds are filled. A continuous or steady flow of water can have little or no effect in removing these matters. Heavy rain storms are the most valuable natural agency in removing such accumulations; the influx of a large and powerful body of water flushes out and cleans the sewers as no artificial agency can. Artificially, the best result can be obtained by opening hydrants and permitting the flow of as large a volume of water as possible through the sewers at stated times. Referring to the waste of water as tending to clean the sewers, unfortunately the greatest source of waste is caused by small leakages which run continuously night and day, and the effect of such streams on the deposit in sewers is inappreciable and valueless, and the quantity of water continuously flowing which would be required to keep the sewers clear of deposit would be enormous.

"The same rule applies to water running in a closet. This is another great source of waste, many people imagining that it is effective in keeping the waste pipe clear. Water works officials have long ago designated this species of waste, along with the waste of leaky fixtures, as "driblets." A single pail of water discharged at once into the waste pipe of a closet will accomplish more in cleaning it out all the way to its entrance into the sewer than the continuous running of that closet for innumerable days and nights, and the consequent wasting of thousands of gallons of water. This is an experiment that any one can try, and if tried, its effect will be found surprising. The force of even such a small body of water rushing in one solid bulk through the confined area of a waste pipe, will move everything before it.

"As to the effect upon public health of the introduction of the meter system, it is only necessary to refer to the vital statistics of those cities where the meter system has been in use for years. The death rate in Providence, Pawtucket, Worcester, Fall River, Yonkers and every other meter city, from diphtheria and kindred diseases, is no greater than it is in cities where there are no meters in use, and where the water consumption is unlimited."

FINANCIAL.

Receipts.

The receipts of the department during the year have been $23,942.17, an increase of $1,166.52 over the last preceding year. These receipts have been from the following sources:

Water rates roll of 1882	$ 1 80	
Water rates roll of 1885	98	
Water rates roll of 1888	10 68	
Water rates roll of 1889	40 32	
Water rates roll of 1890	23,164 69	
Total from water rates		$23,318 47
Plumber's Licenses	$ 60 00	
Rent of boom	200 00	
Service connections	454 45	
Sale of iron pipe	2 85	
Sale of Wyckoff pipe	6 40	
Total from miscellaneous		723 70
		$23,942 17

The total amount of water rates charged on the roll of 1890, $23,486.84, leaving uncollected at the close of the year, $322.15, all of which is due from premises where the supply is shut off or the occupants have removed.

Charged on roll of 1890:

For water supplied at fixed or schedule rates	$14,015 75
For water supplied through meters	9,345 34
For water supplied for building purposes	125 75
	$23,486 84

Collected:

From fixed rates	$13,793 97
From metered water	9,263 97
From building purposes	106 75
	$23,164 69

Uncollected:

From fixed rates	$ 221 78
From metered water	81 37
From building purposes	19 00
	$ 322 15

The collections have been deposited with the City Treasurer, as per receipts on file, as follows:

January 31st, 1890	$ 1,572 38
February 28th, 1890	946 93
March 31st, 1890	1,576 00
April 30th, 1890	2,396 60
May 31st, 1890	1,090 26
June 30th, 1890	1,812 33
July 31st, 1890	2,392 07
August 30th, 1890	1,630 35
September 30th, 1890	1,514 30
October 31st, 1890	2,655 82
November 29th, 1890	1,905 62
December 31st, 1890	4,449 51
	$23,942 17

In addition to the receipts as given above, $10,000 was transferred from the liquor fund to the water works fund per order of the Common Council, as a temporary loan to enable the Board to lay the pipes to the south end of the city. This money is to be refunded from the proceeds of the sale of bonds voted in November.

The total amount collected and uncollected on each year's roll since the works commenced to supply water, has been as follows:

YEARS' ROLL.	COLLECTED.	UNCOLLECTED.	TOTAL ON ROLL.
1873—January 1st to April 30th	$ 728 82		$ 728 82
1873-4—May 1st, 1873, to April 30th, 1874	5,440 80	$ 1 60	5,442 40
1874-5—May 1st, 1874, to April 30th, 1875	6,908 16	44 85	6,953 01
1875—May 1st to December 31st	7,269 55	28 46	7,298 01
1876	9,571 26	82 73	9,653 99
1877	9,604 26	134 19	9,738 45
1878	10,078 15	324 71	10,402 86
1879	11,708 97	136 07	11,845 04
1880	13,155 74	120 25	13,275 99
1881	14,996 61	218 40	15,215 01
1882	17,352 47	158 85	17,511 32
1883	18,713 46	98 64	18,812 10
1884	18,890 77	133 89	19,024 66
1885	19,714 48	272 83	19,987 31
1886	19,344 61	130 74	19,475 35
1887	19,427 75	95 50	19,523 25
1888	21,256 28	143 51	21,399 79
1889	22,118 45	115 05	22,233 50
1890	23,164 69	322 15	23,486 84
Totals	$269,445 28	$2,562 42	$272,007 70

The total amount received by the Board from all sources since commencement of the construction of the works is as follows:

Received from sale of $377,000 in water works bonds	$368,045 87
Received from frontage tax (assessed in 1874 only)	726 07
Water rates collected	269,445 28
Net receipts from service connections, etc	4,998 13
Temporary loan from liquor fund	10,000 00
	$653,215 35

Expenditures.

The expenditures of the Board during the year, not including amount of time orders issued to the Michigan Pipe Co., ($11,629. was $34,463.02, for the following accounts:

For maintenance accounts—

Office department:

Salaries	$ 2,520 00	
Expenses	375 21	
		$ 2,895 21

Street and service department:

Repairs on main distribution	$ 616 17	
Repairs on services and shutting off	233 97	
Repairs and care of water meters	261 16	
Repairs and care of inlet works	426 98	
Service connections	233 12	
		1,771 40

Pumping department:

Salaries of engineers and firemen	$ 3,558 00	
Fuel	1,846 30	
Oil, packing and supplies	349 82	
Repairs on engines and boilers	359 91	
		6,114 03

Repairs to buildings:

Repairs to engine house	85	
		85
Total for maintenance accounts except interest		$10,781 49

Interest account:

Interest on $13,500 special time orders	540 00
Total maintenance	$11,321 49

For construction accounts--

Water meters:

Meters and setting meters	$ 346 28	
		$ 346 28

Main distribution:

Wyckoff pipe	$12,142 10	
Iron pipes and branch casting	630 83	
Valves	987 83	
Fire hydrants	1,015 00	
Laying pipe	3,519 49	
		$18,295 25
Total for construction accounts		$18,641 53

Bills payable:

Special order No. 2, issued in 1886, in payment for pumping engines	4,500 00
Total cash expenditure	$34,468 02

Time orders were issued to the Michigan Pipe Co. for the following accounts:

Main distribution.

Wyckoff pipe	$ 9,848 43	
Iron pipe and branch castings	515 52	
Valves	540 78	
Fire hydrants	725 00	
		11,629 73
Total expenditures, including time orders issued		$46,092 75

The time orders issued are numbered, dated and payable as follows:

Special order No. 5, dated Aug. 1st, 1890, payable Aug. 1st, 1891	$ 4,653 37
Special order No. 6, dated Sept. 1st, 1890, payable Sept. 1st, 1891	3,809 99
Special order No. 7, dated Nov. 1st, 1890, payable Nov. 1st, 1891	3,166 37
	$11,629 73

These orders draw interest at the rate of 4 per cent. per annum. They are to be paid from the proceeds of the bonds voted in November.

Special order No. 2 for $4,500, issued in 1886 to the Holly Manufacturing Co., for pumping engines, became due November 1st, 1890, and was paid at maturity, as well as the annual interest on the balance of these orders remaining unpaid.

The cash expenditures of the Board, as reported to the Co Council, by months, were as follows:

January	$ 755 55
February	759 50
March	924 80
April	945 71
May	1,047 71
June	9,253 91
July	2,673 95
August	1,518 71
September	6,968 07
October	6,664 04
November	1,680 28
December	1,270 79
	$34,463 02

In addition to the expenditures of the Board, the City Tre has paid from monies raised by tax levy, the annual interest o standing bonds issued for the construction of water works, amou to $27,960; and $10,000 of the principal of said bonds, being series No. 4 issued January 15th, 1872, and payable October 1890.

The entire amount expended by the board since the comm ment of the construction of the works is:

For construction accounts	$ 457,216 04
For maintenance accounts	189,697 92
	$ 646,913 96

The entire amount paid by the City Treasurer, from monies by tax levy and which is not carried through the books of the boa

Interest paid on water works bonds (less coupons not presented for payment)	$ 515,600 00
Bonds paid. Series No. 1, 2, 3, 4	40,000 00
	$ 555,600 00

Water Works Fund.

The account with the water works fund and with the City T urer, acting as Treasurer of the Board, has been as follows:

Balance in water works fund January 1st, 1890	$ 6,822 24
Cash collections deposited in fund	23,942 17
Transferred from liquor fund	10,000 00
Withdrawn from water works fund on Recorder's warrants:	
January 30th, 1890, warrant No. 252, per statement No. 37	$
February 28th, " " 253, " " 38	
March 29th " " 254, " " 39	

April 30th, 1890, warrant No. 255, per statement No. 40		945 71
May 31st, " " 256, " " 41		1,047 71
June 30th, " " 257, " " 42		9,253 91
July 31st, " " 258, " " 43		2,673 95
August 30th, " " 259, " " 44		1,518 71
September 30th, " " 260, " " 45		6,968 07
October 31st, " " 261, " " 46		6,664 04
November 29th, " " 262, " " 47		1,680 28
December 31st, " " 263, " " 48		1,270 79
Balance in water works fund December 31st, 1890		6,301 39
	$ 40,764 41	$ 40,764 41

CITY TREASURER, ACTING AS TREASURER OF THE BOARD.	DR.	CR.
To Recorder's warrants, No. 252 to 263, inclusive	$ 34,463 02	
By orders drawn by the Secretary, No. 787 to 1041, inclusive		$ 34,463 0
	$ 34,463 02	$ 34,463 02

Ledger Balance.

Balance sheet for 1890.

LEDGER D.	DEBIT.	CREDIT.
Folio 212, Office department, salaries	$ 2,520 00	
" 213, " " expenses	375 21	
" 214, Street and service department, repairs on main distribution	616 17	
" 215, " " " " services and shutting off	233 97	
" 216, Street and service department, repairs and care of water meters	261 16	
" 217, " " " " " inlet works	426 98	
" 220, Pumping department, salaries	3,558 00	
" 221, " " fuel	1,846 30	
" 222, " " oil, packing and supplies	349 82	
" 223, " " repairs on engines and boilers	359 91	
" 225, Repairs to engine house	85	
" 231, Interest	540 00	
" 227, Water meters	346 28	
" 228, Main distribution, iron pipes and branches	1,143 50	
" 228, " " Wyckoff pipe	21,984 13	
" 229, " " valves	1,528 61	
" 229, " " fire hydrants	1,740 00	
" 230, " " laying pipe	3,519 49	
" 231, Bills payable	4,500 00	
Folio 199, City water works fund		$ 520 85
" 207, Water rates roll of 1890		23,164 69
" 208, " " " 1889		40 32
" 208, " " " 1888		10 68
" 209, " " " 1885		98
" 209, " " " 1882		1 80
" 211, Plumbers' licenses		60 00
" 211, Rents, dockage, etc		200 00
" 218, Service connections		221 33
" 231, Bills payable		11,629 73
" 232, Bay City (Loan)		10,000 00
	$ 45,850 38	$ 45,850 38

Balance of all accounts from January 1st, 1872:

LEDGER D.

Folio 401,	Office expenses and salary account	$ 39,145 40
" 401,	Repairs and care of hydrants, valves and pipes	11,198 73
" 402,	" " " water meters	1,455 76
" 402,	" " " inlet works, reservoir, etc	8,762 78
" 403,	" to engine house	1,192 91
" 403,	" to dock	13 58
" 404,	Engineers' and Firemen's wages	62,960 84
" 404,	Fuel	47,600 13
" 405,	Oil, packing and supplies	7,253 15
" 405,	Repairs to pumping machinery	5,281 11
" 406,	" engine foundations	51 46
" 406,	" boiler arches	942 90
" 407,	Implements and tools. (Repair account)	1,129 37
" 407,	Interest	2,700 00
" 408,	Water works fund	6,301 39
" 418,	Real estate	6,724 83
" 418,	Dock, tramway and store shed	1,882 63
" 419,	Engine house, chimney and wells	19,097 42
" 419,	Engine foundations, boiler foundations and arches	5,881 87
" 420,	Pumping machinery	57,673 05
" 420,	Inlet from Saginaw river	3,218 99
" 421,	Inlet from Saginaw bay	84,778 37
" 421,	Reservoir, breakwater, etc., at bay	24,713 78
" 422,	Iron pipe and branch castings	61,062 72
" 422,	Wyckoff pipe	118,353 69
" 423,	Valves for street mains	12,346 61
" 423,	Public fire hydrants	11,853 09
" 424,	Laying pipe	42,773 67
" 424,	Buildings at bay	452 46
" 425,	Water meters	11,932 39
" 425,	Furniture and fixtures	990 96
" 426,	Implements. (Construction)	1,713 61
" 426,	Engineering and general superintendence. (Construction)	7,856 17
" 427,	Traveling expenses. (Construction)	306 29
" 427,	Insurance expenses. (Construction)	29 00
" 428,	Interest, discount and commission. (Construction)	4,224 17

Folio 410,	Water rates roll from 1872-1880, inclusive	$ 74,46
" 410,	" " " of 1881	14,99
" 411,	" " " 1882	17,25
" 411,	" " " 1883	18,71
" 412,	" " " 1884	18,89
" 412,	" " " 1885	19,74
" 413,	" " " 1886	19,34
" 413,	" " " 1887	19,67
" 414,	" " " 1888	21,25
" 414,	" " " 1889	22,11
" 429,	" " " 1890	25,16
" 415,	Plumber's licenses	23
" 415,	Rents, dockage, etc	1,96
" 416,	Service taps and stop boxes	2,44

Folio 416, Bills payable		20,629 73
" 428, Bay City (loan)		10,000 00
" 417, Bay City bond account		368,045 87
" 417, Water assessment. (Frontage on pipe)		736 07
	$673,845 08	$673,845 08

Water Works Bonds Outstanding December 31st, 1890.

Series.	Date of Issue.	When Payable.	Amount.	Interest.
No. 5	January 15, 1872	October 15, 1891	$ 10,000 00	8 per cent.
" 6	" 15, 1872	" 15, 1892	10,000 00	"
" 7	" 15, 1872	" 15, 1893	10,000 00	"
" 8	" 15, 1872	" 15, 1894	10,000 00	"
" 9	" 15, 1872	" 15, 1895	10,000 00	"
" 10	" 15, 1872	" 15, 1896	10,000 00	"
" 11	" 15, 1872	" 15, 1897	10,000 00	"
" 12	" 15, 1872	" 15, 1898	8,000 00	"
" 13	August 15, 1872	Febr'y 16, 1899	10,000 00	"
" 14	" 15, 1872	" 16, 1900	10,000 00	"
" 15	" 15, 1872	" 16, 1901	10,000 00	"
" 16	" 15, 1872	" 16, 1902	10,000 00	"
" 17	" 15, 1872	" 16, 1903	10,000 00	"
" 18	" 15, 1872	" 16, 1904	9,000 00	"
" 19	" 15, 1873	" 16, 1905	10,000 00	"
" 20	" 15, 1873	" 16, 1906	10,000 00	"
" 21	" 15, 1873	" 16, 1907	10,000 00	"
" 22	" 15, 1873	" 16, 1908	10,000 00	"
" 23	" 15, 1873	" 16, 1909	10,000 00	"
" 24	Febr'y 15, 1874	" 16, 1910	10,000 00	"
" 25	April 15, 1874	April 15, 1911	10,000 00	"
" 26	" 15, 1874	" 15, 1912	10,000 00	"
" 27	" 15, 1874	" 15, 1913	20,000 00	"
" 28	October 15, 1874	October 15, 1894	10,000 00	"
" 29	" 15, 1874	" 15, 1895	10,000 00	"
" 30	" 15, 1874	" 15, 1896	10,000 00	"
" 31	" 15, 1874	" 15, 1897	10,000 00	"
" 32	" 15, 1874	" 15, 1898	10,000 00	"
" 33	March 1, 1875	March 1, 1900	10,000 00	"
" 34	" 1, 1875	" 1, 1901	10,000 00	"
" 35	June 1, 1875	June 1, 1902	10,000 00	"
" 36	" 1, 1875	" 1, 1903	10,000 00	"
" 37	" 1, 1875	" 1, 1905	10,000 00	"
			$337,000 00	

Interest Bearing Orders Outstanding December 31st, 1890.

Order.	Date of Issue	When Payable.	Amount.	Interest.
No. 3	November 1, 1886	November 1, 1891	$ 4 500 00	4 per cent.
No. 4	" 1, 1886	" 1, 1892	4,500 00	"
No. 5	August 1, 1890	August 1, 1891	4,653 37	"
No. 6	September 1, 1890	September 1, 1891	3,809 99	"
No. 7	November 1, 1890	November 1, 1891	3,166 87	"
			$20,629 73	

SOURCE AND SUPPLY.

The difficulty in securing a full supply of water from the
has largely increased during the year; the quantity of water pum
is considerably greater than during any previous year, and the aver
stage of water has been lower. After the spring freshet had subsi
the water level in the bay remained for some weeks several in
higher than for the past two or three years, and it was thought that
turning point was reached. If such were the case, we might rea
ably expect a few years of rising water, which would materially as
in maintaining the supply through the present inlet. But before
summer the water began to recede, and has been slowly but su
going down since that time. At the present time the general leve
the water is lower than at any previous time since the works were b

The river pipe has been open 65 times during the year to help
the supply. The total length of time it was open being 311 hours and
minutes; for fires 26 times—67 hours 25 minutes; for firemen's disp
twice—1 hour 20 minutes; supply cut off by anchor ice 5 times—
hours 55 minutes; low water and inability of pipe from bay to sup
the demand for ordinary use, 32 times—213 hours and 16 minu
The total estimated quantity of water pumped from the river was
million gallons. The dates on which the river pipe was opened w
as follows:

January	7th-8th, Supply cut off by anchor ice	14 hours 35 minutes.
"	8th, " " " "	1 hour.
"	9th, " " " "	6 hours 20 minutes.
"	13th, Low water and insufficient supply	7 hours 30 minutes.
"	14th, " " " "	6 hours.
Febr'y	2d, Fire service	8 hours.
"	13th, " "	10 minutes.
"	25th, " "	2 hours.
March	3d, " "	5 minutes.
"	7th, " "	50 minutes.
"	17th, " "	5 hours.
"	21st, " "	55 minutes.
"	25th, Low water and insufficient supply	4 hours.
"	28th, Supply cut off by anchor ice	3 hours.
April	5th and 6th, Fire service	11 hours 35 minutes.
"	15th, Fire service	7 hours 30 minutes.
May	26th, " "	20 minutes.
June	17th, Low water and insufficient supply	30 minutes.
"	28th, Fire service	20 minutes.
July	4th, Firemen's display	1 hour.
"	5th, Fire service	1 hour.

July	7th,	Low water and insufficient supply.....	4 hours.
"	8th,	" " " "	9 hours.
"	14th,	" " " "	4 hours.
"	17th,	" " " "	5 hours.
"	18th,	Fire service.....	15 minutes.
"	19th,	Low water and insufficient supply.....	1 hour.
"	22d,	" " " "	9 hours.
"	29th,	" " " "	10 hours.
August	13th,	Firemen's display	20 minutes.
"	14th,	Low water and insufficient supply.....	10 hours.
"	15th,	" " " "	10 hours.
"	16th,	" " " "	9 hours.
"	21st,	Fire service.....	2 hours.
"	29th,	" "	9 hours.
Sept'b'r	3d,	Low water and insufficient supply.....	10 hours.
"	4th,	" " " "	10 hours.
"	5th,	" " " "	1 hour.
"	6th,	" " " "	10 hours.
"	9th,	" " " "	9 hours 15 minutes.
"	13th,	Fire service.....	15 minutes.
"	13th,	Low water and insufficient supply.....	9 hours 10 minutes.
"	15th,	" " " "	9 hours 40 minutes.
"	16th,	" " " "	8 hours 45 minutes.
"	17th,	Fire service.....	18 minutes.
"	18th,	Low water and insufficient supply.....	8 hours 50 minutes.
"	19th,	" " " "	6 hours.
"	19th,	Fire service.....	20 minutes.
"	19th,	" "	47 minutes.
"	20th,	" "	25 minutes.
"	24th and 25th,	Fire service.....	12 hours.
October	14th,	Low water and insufficient supply.....	7 hours.
Nov.	2d,	Fire service.....	1 hour.
"	3d,	" "	30 minutes.
"	7th,	" "	20 minutes.
"	9th,	Low water and insufficient supply.....	3 hours 41 minutes.
"	13th,	" " " "	8 hours.
"	15th,	" " " "	2 hours.
"	20th,	Fire service.....	1 hour 30 minutes.
"	21st,	Low water and insufficient supply.....	3 hours 15 minutes.
"	26th,	Fire service.....	1 hour.
Dec.	1st and 2d,	Supply cut off by anchor ice.....	4 hours.
"	13th and 14th,	Low water and insufficient supply	5 hours.
"	23d,	Low water and insufficient supply.....	10 hours.
"	30th,	" " " "	3 hours.
			311 hours 16 minutes.

PUMPING STATION.

The Gaskill and the Holly Quadruplex pumping engines good condition, and the same may be said of the H. P. engine us driving the rotary pumps. Repeated tests of the Gaskill pump no perceptible slip, and no deductions have been made from estimated capacity in determining the quantity of water pump the year. The rotary pumps show more deterioration; although pumps are seldom used, it is necessary that they be kept in goo dition, as they may be required at any time for use in connectio the quadruplex engines, if there should be a large demand upo works when the Gaskill engines are shut down for packing or r

The Gaskill engines developed a slight weakness in one main pillow blocks during the past summer, due, without doubt, careless handling of elevator valves in the city when the work being operated under heavy fire pressure, which sometimes caus engines to start and stop very suddenly and brings a terrible upon the working parts of the engine. To guard against any development of this weakness, cast steel braces were procured fo main bearings, and one was placed on the side which showed a ten to give away. The result was satisfactory, holding the bearing in position, and the other will be placed when occasion requires. replacing the cast iron followers in the Gaskill pumps with partially completed in 1889, was finished during the year. New gibs have been placed in the main connection rods, and some repairs made on the air pumps. Total cost of repairs on G engines, $111.55.

The only repairs required on the quadruplex engines have be the valves in the discharge pipes from the pumps. The angle va the right back pump is cracked, and has been temporarily repaire clamps. The 10-inch valve which separates the discharge of the pumps from the back ones on this set could not be closed, and necessary to place new cage, discs and stem therein. The c repairs to quadruplex engines was $25.45. The boilers have re no very extensive repairs; the repairs made consist principally of ing flues and seams. In December the three boilers were gone carefully, seams caulked, corroded rivets removed and replace breeching patched, and the boilers placed in good condition.

insurance on the boilers was placed in December with the Hartford Steam Boiler Inspection and Insurance Company. Part of the feed pipes to the boilers have been renewed twice during the year; the last time galvanized iron was used as an experiment; if this does not last longer than the common wrought iron pipe, brass pipe should be put in. Seven sections of new grate bars, weighing 1,082 pounds, have been purchased to place under the boilers in place of bars burned out. Total cost of repairs on boilers, including insurance policy and inspection, $222.91.

The contract made with Dolsen, Chapin & Co. in 1889 for furnishing fuel for one year, was extended to cover another year's supply. The price paid for slabs and edgings piled on water works yard was 35 cents per cord, to be paid for monthly as burned. At the commencement of the year there were 1,014¼ cords of slabs of the cut of 1889 piled on the yard; these were consumed before the cut of 1890 were dry enough to burn, and 279¾ cords more of the cut of 1889 were purchased from the same parties at the same price as for wood piled on water works yard, but it was located at a point more difficult of access, and the cost of delivering a portion of this wood in the fire room was 5 cents per cord more than from the water works yard. 2,883½ cords of the cut of 1890 have been piled on the water works yard, of which 1,530 cords have been delivered in fire room and paid for, leaving 1,353½ cords piled on yard not yet paid for. Total amount of wood delivered in fire room during the year, 2,824 cords, costing $1,846.30. Quantity consumed, 2,822 cords, costing $1,845.00. This amount is 484 cords more than was burned in 1889. This increase is due partially to the inferior quality of the fuel, and partiallly to the increased quantity of water pumped, and the greater pressure under which it was pumped, and the considerable increase in time and pressure under which the works were run for fire service.

Sundays from 10 a. m. to 12 m. and from 7 p. m. to 9 p. m. the pressure is carried at 45 pounds to provide better service to the motors used for blowing church organs. Early in the summer the 40 pounds usually carried for domestic service was found to be insufficient to furnish an adequate supply to the upper floors of some of the highest business blocks, and since June 14th the domestic pressure has been carried at 45 pounds from 6 a. m. to 6 p. m. except Sundays. This makes the average domestic pressure for the year 41 6-10 pounds. Total quan-

tity of water pumped under domestic pressure, 970,324,930 g
Quantity pumped under fire pressure, 18,446,523 gallons. A
fire pressure carried, 86 6-10 pounds.

The Gaskill engines were run	8,674 hours.
Quadruplex engines were run	87 hours 54 minutes.
Rotary pumps were run	19 hours 19 minutes.

The longest continuous run of the Gaskill engines was 5
from September 30th to November 19th. The quantity of
pumped by Gaskill engines was 975,759,367 gallons. Quantity p
by quadruplex engines, 11,885,445 gallons, and by rotary
1,126,641 gallons.

The greatest quantity of water pumped in one day was 3,
gallons, July 23d, and the least quantity pumped was 2,038,48
lons, January 12th.

The net cost of running the pumping engines was $6,07
follows:

Salaries of engineers and firemen	$3,558 00
Fuel consumed	1,845 00
Oil, packing and supplies used	314 72
Repairs on engines and boilers	359 91
	$6,077 63
Cost per million gallons pumped	6 15
" " " " raised 100 feet	5 29
Cost of fuel per million gallons pumped	1 87
" " " " " raised 100 feet	1 64

Assuming one cord of the fuel used to equal 550 pounds o
the fuel burned would equal 1,553,200 pounds of coal.

The average lift of all the water pumped was 114 feet f
surface of the water in the wells.

Duty based on the above assumed value of fuel, 60,525,646

WATER PUMPED. 1890.

MONTH.	GASKILL ENGINES.			QUADRUPLEX ENGINES.			ROTARIES.			TOTALS.		FIRES.					
	Hours Run.	Revolutions.	Gallons Pumped.	Hours Run.	Revolutions.	Gallons Pumped.	Hours Run.	Revolutions.	Gallons Pumped.	Gallons Pumped.	Daily Average.	No. Alarms.	Hours Run.	Highest Pressure.	Lowest Pressure.	Average Pressure.	Gallons Pumped.
January.....	742.45	580,620	70,255,020	1.15	3,295	181,225	.....	.....	.....	70,436,245	2,272,137	7	2.51	80	80	80	414,909
February....	668.33	571,200	69,115,200	3.23	8,697	478,335	.04	639	10,863	69,604,398	2,485,871	20	18.08	100	80	85	2,913,196
March.....	741.55	644,646	78,002,166	2.05	5,232	287,760	.....	.....	.....	78,289,926	2,525,481	15	14.23	100	80	84½	2,470,578
April.....	705.37	587,294	71,062,574	14.23	35,176	1,934,680	.....	.....	.....	72,997,254	2,433,242	15	22.17	110	70	100	4,079,273
May.....	721.15	612,032	74,055,672	22.45	53,700	2,953,500	.....	.....	.....	77,009,372	2,484,173	6	2.07	90	80	84	361,306
June.....	710.20	683,556	82,710,276	9.40	26,096	1,435,280	3.30	4,214	71,638	84,217,194	2,807,240	7	2.13	80	80	80	391,677
July.....	742.10	806,335	97,566,535	3.08	6,764	372,020	.55	3,910	66,470	98,005,025	3,161,452	13	3.49	100	80	89	892,837
August.....	724.55	759,698	91,923,458	19.45	48,181	2,649,955	10.10	38,663	657,271	95,230,684	3,068,732	11	10.35	105	50	76	2,152,448
September...	714	760,522	92,023,162	6	14,572	801,460	4 40	18,847	320,399	93,145,021	3,104,834	11	15.33	90	80	83	3,034,438
October.....	744	723,342	87,524,382	.....	.....	.....	.....	.....	.....	87,524,382	2,823,367	1	27	80	80	80	80,828
November...	714.30	664,698	80,427,853	5.30	14,386	791,230	.....	.....	.....	81,219,083	2,707,303	18	7.18	90	80	83	1,349,029
December...	744	670,189	81,092,869	.....	.....	.....	.....	.....	.....	81,092,869	2,615,899	7	1.53	90	80	81	306,009
Totals.....	8674	8,064,127	975,759,367	87.54	216,099	11,885,445	19.19	66,273	1,126,641	988,771,453	2,708,963	131	101.34	110	50	86.6	18,446,523

The total quantity of water pumped each year since the wo commenced operations, has been as follows:

	Gallons.		Gallons.
1873	142,477,725	1882	775,642,466
1874	294,714,798	1883	773,942,702
1875	416,756,579	1884	831,867,463
1876	518,197,129	1885	836,970,046
1877	538,847,186	1886	779,761,862
1878	530,197,397	1887	827,195,009
1879	672,344,128	1888	872,990,164
1880	827,067,372	1889	944,472,747
1881	944,382,043	1890	988,771,453

Pumping Plant.

BOILERS—Three horizontal return tubular boilers, 16 feet long, ft. diameter of shell, 105 tubes $2\frac{3}{4}$ inches interior diameter in e boiler, the boilers set in separate brick arches. Area of grate surf under No. 1 boiler, $27\frac{1}{2}$ square feet; under No. 2 and 3 boilers, e 34 feet. Heating surface of each boiler ($\frac{1}{2}$ shell, 138.24 square f tubes, 1,209.51 square feet), 1,347.75 square feet. Steam pres carried, 65 pounds.

ENGINES AND PUMPS—One Gaskill horizontal compound cond ing crank and fly-wheel pumping engine, maximum capacity 5,000, gallons in 24 hours. One Holly quadruplex compound condens crank and fly-wheel pumping engine, maximum capacity 3,000, gallons in 24 hours. One horizontal high pressure piston engine, d ing through gears two No. 10 Holly rotary pumps, maximum capa 2,500,000 gallons in 24 hours.

Capacity of Gaskill pumps, per revolution	121 gallons.
Capacity of Quadruplex pumps, per revolution	55 gallons.
Capacity of Rotary pumps, per revolution	17 gallons.

MAIN DISTRIBUTION.

Distributing mains have been laid during the year as follows:

A 6-inch Wyckoff pipe in Fourth avenue from Green avenue to Livingstone avenue, with one fire hydrant.

A 6-inch Wyckoff pipe in McLellan street from Center avenue to Eighth street, with three fire hydrants.

A 10-inch Wyckoff pipe in Van Buren street from Second street to Thirteenth street, with eleven fire hydrants.

A 10-inch Wyckoff pipe in Saginaw street from Tenth street to Twelfth street, with four fire hydrants.

A 10-inch Wyckoff pipe in Bowery from Twelfth street to Fremont avenue, with sixteen fire hydrants.

A 10-inch Wyckoff pipe in Fremont avenue from Bowery to Jennison avenue.

A 10-inch Wyckoff pipe in Jennison avenue from Fremont avenue to South Center street, with six fire hydrants.

An 8-inch Wyckoff pipe in Michigan avenue from Twenty-third to Twenty-fifth street, with two fire hydrants.

A 6-inch Wyckoff pipe in Michigan avenue from South Center street to Fremont avenue, with five fire hydrants.

An 8-inch Wyckoff pipe in Polk street from Fremont avenue to South Center street, with seven fire hydrants.

An 8-inch Wyckoff pipe in Bullock road from Harrison street to River street, with one fire hydrant.

An 8-inch Wyckoff pipe in River stret from Bullock road to South Center street, with four fire hydrants.

A 10-inch Wyckoff pipe in South Center street from River street to Jennison avenue.

A 10-inch Wyckoff pipe in Twenty-third street from Water street to Bowery.

The 6-inch Wyckoff in South Center street was taken up from Harrison street to Jennison avenue. Also, the 6-inch Wyckoff pipe in Twenty-third street from Water street to Bowery. The fire hydrants formerly connected with these pipes taken up, were reset from the 10-inch pipe, no new ones being added on these lines.

The pipe taken up in South Center street and Twenty-third street was taken to the factory of the Michigan Pipe Co., tested, recoated and

new thimbles put in, and again used in laying the lines of pipe Fourth avenue, McLellan street and Michigan avenue. Nearly al this pipe was first laid in 1874, but it was found in good condition. nearly one mile of pipe taken up, less than 50 feet of 6-inch pipe about 20 feet of 4-inch was found defective and not relaid. The 6- pipe culled was principally old sleeves and short pieces of pipe w were never of the best quality; the sleeves had been battered u good deal in their first laying. In addition to the pipe above n tioned as taken out, it was necessary to remove sections from pipe merly laid to insert branch castings to connect the new lines of pip follows:

One section of 8-inch Wyckoff pipe in Harrison street at S Center street.

One section of 8-inch Wyckoff pipe in Harrison street at Bul Road.

One section of 8-inch Wyckoff pipe in Fremont avenue at Pol

Four sections of 6-inch Wyckoff pipe in Thirteenth street at Bow

Two sections of 6-inch Wyckoff pipe in Thirteenth street at Buren street.

One section of 8-inch Wyckoff pipe in Tenth street at Buren street.

One section of 6-inch Wyckoff pipe in Center avenue, south at Van Buren street.

One section of 6-inch Wyckoff pipe in Center avenue, north at Van Buren street.

One section of 6-inch Wyckoff pipe in Center avenue, south at McLellan street.

One section of 10-inch Wyckoff pipe in Water street at Twe third street.

Total length of pipe taken out or abandoned during the year:

	10-in.	8-in.	6-in.	4-in	Tota
Wyckoff pipe	7 ft 8 in.	27 ft. 4 in.	4,679 ft. 8 in	91 ft. 9 in	4,806 ft.
Cast iron pipe and branches	.....	6 ft.	86 ft.	23 ft. 6 in.	115 ft.
Total	7 ft. 8 in.	33 ft. 4 in.	4,765 ft. 8 in.	115 ft. 3 in.	4,921 ft.

23 feet of 6-inch Wyckoff pipe thrown out of service was lef the ground at Twenty-third street, crossing Broadway, on account

the difficulty of removing it from nnder the street car tracks; all of the balance of the pipe thrown out of service was taken out. In laying the new lines of pipe in South Center street and in Twenty-third, it was deemed advisable to change the location to a line nearer to one side of the street, causing some additional expense to excavate another trench, connect up branch mains and service pipes in use. The service pipes on these streets were connected with the new mains at the expense of this department, without expense to the consumer, except when the consumer desired to change the location or size of connection.

The cost of the several lines of pipe laid during the year has been as follows (the cost of taking up old pipe being charged to the street from which it was taken, and the cost of testing, re-coating, and new thimbles for this pipe, to the street where it was re-laid):

Fourth avenue from Green to Livingston avenue	$ 168 94
McLellan street from Center avenue to Eighth street	337 31
VanBuren street from Second to Thirteenth street	5,573 14
Saginaw street from Tenth to Twelfth street	1,659 44
Bowery from Twelfth street to Fremont avenue	7,304 05
Michigan avenue from Twenty-third to Twenty-fifth street	642 39
Michigan avenue from South Center street to Fremont avenue	765 70
Fremont avenue from Jennison avenue to Bowery	176 50
Jennison avenue from South Center street to Fremont avenue	2,944 24
Polk street from South Center street to Fremont avenue	2,315 08
Bullock road from Harrison street to River street	322 27
River street from Bullock road to South Center street	1,689 97
South Center street from River street to Jennison avenue	3,713 51
South Center street crossing Michigan avenue	7 68
Twenty-third street from Water street to Bowery	2,300 26
	$29,920 48
Paid the Michigan Pipe Co. for overweight on exchange of three sections of 8-in. cast iron pipe	4 50
	$29,924 98

The estimated cost of these lines of pipe, not including the pipe in VanBuren street, and the pipe in Michigan avenue from Twenty-third to Twenty-fifth street, was $25,000. Their cost was $23,709.45.

The total length of pipe laid during the year was:

	10-inch.	8-inch.	6-inch.	4-in.	Total.
Wyckoff pipe	19,556 ft.	5,480 11-12 ft.	4,629 10-12 ft.	357 1-12 ft.	30,023 10-12 ft.
Iron pipe and branches	176 11-12 ft.	43 4-12 ft.	28 11-12 ft.	14 ft.	263 2-12 ft.
Totals	19,732 11-12 ft.	5,524 8-12 ft.	4,658 9-12 ft.	371 1-12 ft.	30,287 ft.

Total length of distributing mains in use:

	20-in.	16-in.	12-in.	10-in.	8-in.	6-in.	4-in.	3-in.	
Wyckoff pipe..	.....	.....	.....	34,198 10-12	23,966 9-12	78,782	21,966 4-12	319	13
Cast iron pipe.	44	1,467	9,083	8,704 8-12	2,044 5-12	1,022	786 3-12	.....	2
Totals	44	1,467	9,083	42,903 6-12	26,011 2-12	79,804	22,752 7-12	319	18

Total Wyckoff mains..... 30 miles 832 feet 11 inches.
Total cast iron mains..... 4 miles 2,031 feet 4 inches.

Total distributing mains..... 34 miles 2,864 feet 3 inches.

In removing the several lines of pipe mentioned as taken ou valves were removed as follows:

	6-inch.	4-inch.	Total.
Flowers patent.....	9	4	13
Galvin patent.....	....	2	2
Total	9	6	15

These valves were all reset except three 6-inch Flower which were lead jointed to iron pipe and could not be used in W mains.

Stop valves put in:

	10-inch.	8-inch.	6-inch.	4-inch.	
Flowers patent.....	17	7	11	64	
Galvin patent.....	.....	.....	.....	2	
Total.....	17	7	11	66	

This does not include three 10-inch Galvin valves taken ou repairs and Flower valves substituted for them.

Total stop valves in use in distributing mains:

	16-in.	12-in.	10-in.	8-in.	6-in.	4-in.	3-in.
Flower patent.	1	3	31	38	97	277	5
Galvin patent.....	1	2	1	1	5	45	.....
Brown patent.....	.....	1	.....	.....	1	.....	.....
Total.....	2	6	32	39	103	322	5

Fire hydrants were taken out as follows:

Four Holly pattern.
Two Matthews pattern.

All of which were reset on the new lines of pipe.

Fire hydrants put in:

Holly pattern	4
Matthews pattern	62
Total	66

Total fire hydrants in use:

Holly pattern	131
Gaskill pattern	15
Matthews pattern	137
Galvin pattern	5
Brown pattern	1
Total	289

Two Matthews hydrants have crane attachment for filling street sprinkler carts.

All hydrants are double discharge post hydrants with 4-inch inlet

Repairs.

The number of leaks discovered in the main pipes during the year was 34, of which 33 were in Wyckoff mains and 1 in cast iron main.

The location and character of these leaks were as follows:

Date.	Size.	Kind of pipe.	Location.	Character.	How Repaired.
Mar. 24	4-inch	Wyckoff	Alley bet. Saginaw and Washington	joint	plugged.
April 23	6-inch	"	Cor. Green and 4th ave.	plug joint	plugged.
May 9	6-inch	"	Water street south of 9th street	joint	plugged.
" 12	6-inch	"	Water street south of 9th street	joint	plugged.
June 9	4-inch	"	Alley between Jackson and Van Buren	joint	plugged.
" 19	10-inch	"	Harrison street south of 31st street	joint	plugged.
July 2	8-inch	"	Harrison street south of 35th street	joint	plugged.
July 10	6-inch	"	Woodside avenue west of Shearer street	old sleeve	new sleeve.
" 25	8-inch	"	Polk street south of 32d street	joint	new pipe.
Aug. 4	10-inch	"	Water street at 26th street	3 joints	3 new pipe.
" 9	10-inch	"	Bowery south of 25th street	knot hole	plugged.
" 23	10-inch	"	Bowery north of 21st street,	knot hole	plugged.
" 25	4-inch	"	Bowery at 26th street	knot hole	plugged.
" 25	8-inch	"	Harrison street south of 32d street	joint	plugged.
" 29	20-inch	cast iron	Water street at pumping station	plug blew out	put in again
Sept. 9	8-inch	Wyckoff	Alley between Jefferson and Madison	old sleeve	new sleeve.
" 11	4-inch	"	Alley bet. Saginaw and Washington	bands broken	new pipe.
" 22	8-inch	"	Alley between Jefferson and Madison	bands broken	new pipe.
" 25	10-inch	"	Water at 21st street	joint	plugged.
Oct. 3	6-inch	"	Anna street north of Lord	joint	plugged.
" 13	10-inch	"	Water street, north of 21st street	knot hole	plugged.
" 24	10-inch	"	Fremont avenue and Jennison avenue	knot hole	plugged.
" 25	10-inch	"	Water street at 29th street	joint	plugged.

Nov.	5	10-inch	"	Water street south of 24th street	joint
"	6	10-inch	"	Water street north of 21st street	4 joints bands broken
"	7	8-inch	"	22d street west of Madison street	knot hole
"	10	8-inch	"	River street at 37th street	knot hole
"	19	4-inch	"	Alley between Jackson and Van Buren	bands broken
Dec.	4	10-inch	"	Water street at 23d street	joint
"	8	6-inch	"	Center avenue east of Adams street	old sleeve
"	9	8-inch	"	Alley between Jefferson and Madison	old sleeve
"	10	8-inch	"	Polk street north of 32d street	knot hole
"	10	10-inch	"	Water street north of 19th street	joint
"	20	6-inch	"	Water street at 9th street	old plug

The one leak in cast iron was caused by the 20-inch plug in in front of engine house blowing out while the works were under fire pressure for the Gates mill fire. The cost of repai was $14.66, including the cost of clamps to secure these plugs the possibility of their again blowing out.

The cost of repairing the 33 leaks in Wyckoff pipe was of which $119.92 was for labor and $82.11 for material. Three Galvin valves put in in 1886 refused to operate satisfactorily an taken out and returned to the Michigan Pipe Co., who furnishe and Flower valves put in their places. The cost of making this was $139.67, but the price paid for the new valves, $88.89, is back to the Michigan Pipe Co.

Six lines of pipe have been raised or lowered to make sewers. The cost of these changes in grade was $59.80.

About 100 feet of pipe in the alley between Jackson a Buren streets was moved a short distance to clear the foundatio of the Presbyterian church in course of erection on the corner o avenue and Jackson street at a cost of $8.25.

The balance of the repairs on main distribution, costing was for replacing wooden valve boxes with iron, repairs on val hydrants, inspector's time examining and blowing off hydra flushing pipes, and the necessary tools and repairs on tools used department.

WATER METERS.

The number of water meters put in during the year was 38, and the number taken out 17, making total number of meters in use at the close of the year 267, elevator and motor indicators 3.

The meters set were of the following sizes and patterns:

	3-in.	2-in.	1½-in.	1-in.	¾-in.	⅝-in.	½-in.	Total.
Union Rotary	1			2	1	1		5
Union Duplex						1		1
Crown			1	3	5			9
Empire					2		1	3
Worthington		1						1
Hersey						6		6
Thomson					2	11		13
Total	1	1	1	5	10	19	1	38

Meters taken out:

	1½-in.	1-in.	¾-in.	⅝-in.	½-in.	Total.
Union Rotary		2				2
Union Duplex				2		2
Crown	1	4	4			9
Empire			1		1	2
Worthington	1					1
Hersey				1		1
Total	2	6	5	3	1	17

Meters in service December 31st, 1890:

	8-in.	4-in.	3-in.	2-in.	1½-in	1-in.	¾-in.	⅝-in.	½-in.	⅜-in.	Total.
Union Rotary	1	5	19	5	4	3	1	2			40
Union Duplex								20			20
Crown					1	23	30		28	1	83
Empire						6	34		22		62
Worthington				5	5			10			20
Hersey						2	5	22			29
Thomson							2	11			13
Total	1	5	19	10	10	34	72	65	50	1	267

Elevator indicators 2
Motor indicators 1

Eighty-seven meters and the three motor indicators are classed as manufacturing; 172 meters are classed as domestic and 8 are test meters on premises paying assessment rates.

Of the meters taken out, 3 were removed because they failed to register; these were replaced by others of the same size and pattern;

3 were taken out on account of such changes in the uses of wa
the premises as to render the size unsuited to the quantity o
passing through them, and were replaced by other meters of
capacity ; 11 were taken out because the use of water throu
pipes to which they were attached was permanently discontinu
premises being supplied through other services, or the bu
removed and all use of water on the premises abandoned. On
has been seriously injured by frost, 10 have required minor
usually in the registering mechanism, and 48 have been fou
registering but requiring no repairs more than the removal
piston and taking out the obstruction which usually consisted o
pieces of wood or small fish.

The total quantity of water supplied through meters was
965,627 gallons, an increase of a little more than 10,000,000 ab
year 1889. Of this amount 71,585,775 gallons were supplied f
ufacturing purposes and yielded a revenue of $5,737.19, and 3
852 gallons were supplied through meters classed as domest
returned a revenue of $3,526.78. Total revenue from metered
$9,263.97, an average of about $8\frac{2}{3}$ cents per 1,000 gallons.

SERVICES.

The number of new service connections made with the mai
during the year was 124, and the number taken out was 38;
number of service connections in mains, 1,632.

Service connections put in :

	4-in. branch	1-inch.	¾-inch.	⅝-inch.	½-inch.
In Wyckoff mains.....	1	14	11	57	38
In cast iron mains....	.....	1	.....	1	1
Total.....	1	15	11	58	39

Service connections taken out:

	2-inch.	1-inch.	¾-inch.	⅝-inch.	½-inch.
From Wyckoff main....	2	3	7	15	11

Service connections in main pipes December 31st, 1890:

	BRANCHES.					CORPORATIONS.							
	8-in	6-in	4-in	3-in	2-in	2-in.	1¼-in	1-in	¾-in.	⅝-in	½-in.	⅜-in.	Total.
In Wyckoff mains...	1	3	13	1	1	11	.....	175	420	281	474	.....	1,380
In cast iron mains...	....	2	9	....	....	2	6	47	58	35	88	5	252
Total.....	1	5	22	1	1	13	6	222	478	316	562	5	1,632

Sixty-seven of these connections are shut off at the main, but may be renewed, leaving service connections open, 1,565.

The number of services supplied through the new service connections put in, was 97, and 10 new branch services were connected with service pipes put in in previous years; 9 services have been abandoned and not replaced; whole number of separate services December 31st, 1890, 1,684, of which 1,310 are open and 374 closed at the curb.

The number of services opened by employes of the Board during the year was 278, and the number shut off 282. Of the services shut off 66 were closed at the request of consumer, 104 premises found vacant, 36 for leakage and 76 for non-payment of water rates.

Of the 374 services shut off at the close of the year, 17 are to supply dwellings or business blocks in course of erection and not completed, 57 are services leading to vacant lots and 39 are services through which only a portion of the supply on the premises was drawn, the same premises being at present supplied through other services which are open.

Accompanying this report will be found the usual tables showing uses for which water is supplied, material used for running pumping engines, etc.; also a summary of statistics compiled in accordance with the form recommended by the New England Water Works Association.

All of which is respectfully submitted.

E. L. DUNBAR,
Superintendent and Secretary.

Office Board of Water Works.
Bay City, February 7th, 1891.

Material consumed in running pumping engines. 1890.

	Cost.
2822 cords of wood	$1,845 0
119 4-10 gals. cylinder oil	56 0
27 lbs. lubricant	3 4
½ gal. lard oil	4
5 lbs. plumbago	1 2
4 lbs. cotton packing	1 3
14½ lbs. hemp packing	2 9
1 lb. Heston packing	1 5
3¼ lbs. "Goodsell" packing	4 8
15½ lbs. Eureka packing	7 7
8 lbs. "Fibrous" pump packing	12 0
57½ lbs. square rubber packing	28 2
6¼ lbs. sheet rubber	3 6
1½ lbs. boiler gaskets	8
4 rubber air pump valves	15 7
Leather and bolts for pump valves	13 0
Wicking and packing paper	6
3 lbs. red lead	3
Sheet brass, copper, copper rod and solder	2 4
5 gals. asphaltum	3 7
329 lbs. boiler compound and phosphates	38 3
305 lbs. wipers	14 3
5 lbs. tripoli	3
½ doz. brooms	1 6
53 bars soap, 3 boxes concentrated lye	2 2
503 gals. kerosene oil	43 8
Lamp chimneys, burners, &c	1 3
64 boxes matches	9
1 gauge glass	2
Ice	20 0
Steam hose, files, oilers, &c	30 8
	$2,139 7

Material on hand December 31st, 1890:

	Cost.
10 cords wood	$ 6 5
55 gals. cylinder oil	25 2
21 lbs. lubricant	3 1
½ gal. lard oil	4
1 gal. boiled oil	7
39 lamp chimneys	1 9
1½ doz. wicks	2
2 lbs. red lead	3
6 lbs. cotton packing	1 8
18½ lbs. hemp packing	3 7
3¼ lbs. ⅛-in. square rubber packing	1 8
15¼ lbs. 1-in. square rubber packing	7 6
11½ lbs. boiler gaskets	6 3
9½ lbs. sheet rubber	2 3

8 lbs. Heston cone packing	12 00
4¾ lbs. Goodsell packing	7 13
3½ lbs. Fibrous pump packing	5 25
10½ lbs. rubber air pump valves	15 75
2¼ lbs. Eureka packing	1 13
12 lbs. leather	3 84
50 lbs. wipes	1 50
1 lb. rotten-stone	15
½ lb. oxalic acid	12
4 lbs. emery	60
250 lbs. tri-sodium phosphates	40 00
28 bars soap	1 00
47 gals. kerosene oil	3 64
38 boxes matches	50
8½ lbs. sheet brass	1 15
40 ft. steam hose	19 20
	$175 21

Uses supplied at fixed or schedule rates:

1	Ashery.
3	Bakeries.
3	Banks.
11	Barber shops.
8	Bath rooms (public.)
1	Bath room (Turkish.)
227	Baths (private.)
4	Blacksmith shops.
8	Boilers (for power.)
7	Bottling works.
9	Boarding houses.
22	Business blocks—not classified.
1	Business college.
10	Butcher shops.
1	Broom factory.
2	Carriage shops.
1	Cemetery.
1	Chapel.
3	Churches.
2	Cigar factories.
2	Clothes cleaning.
710	Dwellings.
1	Express office.
108	Families in block.
3	Fire pipes.
1	Fish market.
2	Fountains.
1	Foundry.
1	Gas works.
4	Gas engines.
2	Gun shops.
7	Halls (public.)
2	Harness shops.
380	Hose for sprinkling.
31	Hotels.
1	Laboratory.
3	Laundries.
2	Machine shops.
29	Offices.
1	Paint shop.
1	Pawn shop.
1	Passenger depot.
4	Photograph galleries.
3	Plumber shops.
1	Postoffice.
1	Printing office.
2	Refrigerators.
8	Restaurants.
1	Rink.
55	Saloons.
1	Salt crusher.
14	School buildings.
9	Stables (livery.)
7	Stables (mill.)
142	Stables (private.)
1	Stable (sale.)
1	Suspender factory.
1	Stone yard.
99	Stores.
2	Tailor shops.
2	Telegraph offices.
1	Undertaker.
723	Water closets.
60	Water closets in schools.
10	Water motors.
1	Wood yard.
2	Ware houses.

Uses supplied through meters:

2 Bakeries.
79 Baths (private.)
1 Bath house (public.)
3 Bottling works.
12 Business blocks (not classified.)
38 Boilers (for power)
7 Box factories.
1 Brewery.
1 Boarding house.
2 Barber shops.
1 Boiler shop.
2 Banks.
2 Butcher shops.
1 Business college.
1 Club room.
1 Court house.
1 County jail.
4 Churches.
1 Cooper shop.
1 Coal and wood yard.
1 Carriage factory.
1 Cracker factory.
1 Cross arms factory.
144 Dwellings.
9 Drill houses.
1 Electric light station.
2 Elevators.
3 Flouring mills.
4 Foundries.
1 Furniture factory.
1 Gas engine.
2 Green houses.
82 Hose for sprinkling.
16 Hotels.
1 Hall.
1 Locomotive stand pipe.
2 Laundries.
1 Mortar yard.
5 Machine shops.
17 Offices.
1 Opera house.
2 Planing mills.
2 Passenger depots.
1 Pipe works.
2 Printing offices.
1 Plow works.
1 Plumber shop.
1 Photograph gallery.
1 Reel factory.
1 Round house.
2 Restaurants.
6 Saloons.
6 Stables (livery.)
2 Stables (street car.)
7 Stables (mill.)
32 Stables (private.)
2 Stables (hotel.)
1 Stable (bus and hack.)
13 Stores.
14 Saw mills.
13 Salt blocks.
1 School.
1 Sash, blind and door factory
20 Water motors.
1 Wooden ware works.
347 Water closets.
24 Pipes for fire protection.

Premises and uses shut off:

1 Bank.
1 Boiler shop.
10 Baths (private.)
5 Blacksmith shops.
3 Boarding houses.
1 Boat dock.
1 Box factory.
2 Butcher shops.
3 Business blocks (not classified.)
1 Church.
150 Dwellings.
2 Drill houses.
1 Elevator.
1 Foundry.
51 Hose for sprinkling.
6 Hotels.
6 Hydrants (fire protection.)
1 Machine shop.
1 Market garden.
4 Offices.
6 Pasture lots.
1 Restaurant.
10 Saloons.
2 Saw mills.
3 Salt blocks.
1 Shingle mill.
3 Soap factories.
16 Stables.
44 Stores.
1 Slaughter house.
1 Tool house.
5 Vacant buildings
57 Vacant lots.
30 Water closets.

City uses for which no payment is made:

1 City building occupied by police station and city offices.
1 City building occupied by public library and city offices.
6 Hose and truck houses; 17 horses and two steam fire engines.
15 Water closets in city buildings.
1 Electric light station (two boilers.)
9 Public watering troughs.
2 Ornamental fountains in public square.
10 Hose for sprinkling parks.
289 Public fire hydrants.

SUMMARY OF STATISTICS.

REPORT OF 1890.

Water Works of Bay City, Bay County, Michigan.
Date of construction, 1872.
By whom owned, Bay City.
Source of supply, Saginaw Bay, an arm of Lake Huron.
Mode of supply, direct pumping.

PUMPING.

1. Builders of pumping machinery, Holly Manufacturing Company.
2. Kind of fuel, pine slabs and edgings.
3. Fuel consumed, 2.822 cords—cost $1,845.00. Equal to soft coal, 1,553,200 lbs.
6. Total pumped in gallons, 988,771,453.
8. Average dynamic head, 114 feet.
9. Number of gallons pumped per pound of coal, 637.
10. Duty $= \frac{988,771,453 \times 8.34 \times 100 \times 114}{1,553,200.} = 60,525,646.$
Cost of pumping, figured on pumping station expenses, $6,077.63.
11. Per million gallons pumped, $6.15.
12. Per million gallons raised one foot, $0.054.
Cost of pnmping figured on total maintenance, including interest paid by city, $39,281.49.
13. Per million gallons pumped, $39.72.
14. Per million gallons raised one foot, $0.35.

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13. Per million gallons pumped, $39.72.
14. Per million gallons raised one foot, $0.35.

CONSUMPTION.

1. Estimated population to date, 30,000.
2. Estimated population on lines of pipe, 17,500.
3. Estimated population supplied, 12,000.
4. Total gallons consnmed, 988,771,453.
5. Passed through domestic meters, 35,379,852 gallons, 3½ per cent.
6. Passed through manufacturing meters, 71,585,775 gallons, 7¼ per cent.
7. Average daily consumption, 2,708,963.
8. Gallons per day to each inhabitant, 90.
9. Gallons per day to each consumer, 226.
10. Gallons per day to each service (distribution 22) 1,731.

DISTRIBUTION.

1. Material, cast iron and Wyckoff.
2. Sizes, 3-inch to 20-inch.
3. Extended, 30,287 feet.
4. Abandoned, 4,922 feet.
5. Total in use, 34⅛ miles.
6. Cost of repairs, $17.86 per mile.
7. Leaks per mile, 1.
8. Small distribution less than 4 inches, 319 feet.
9. Hydrants added, 60.
10. Number in use, 289.
11. Stop gates added, 86.
12. Number in use, 509.
13. Number of small gates less than 4-inch, 5.
14. Number of blow-off gates, 21.
15. Range of pressure at center day and night, 30 to 37 lbs.

SERVICES.

16. Material, lead, wrought iron and Wyckoff pipe.
17. Sizes, ¾-inch to 8-inch.
21. Service taps added, 86.
22. Number in use, 1,565.
25. Meters added, 21.
26. Number in use, 267. Domestic, 172; manufacturing, 87; test, 8.
27. Motors and elevators added, 9.
28. Number in use, 32.

Financial — Maintenance.

RECEIPTS—DIVISION I.

A.—Water rates, domestic	$17 075 28	
B.—Water rates, manufacturing	6,143 19	
C.—Net receipts from water		$23,218 47
D.—Miscellaneous, service connections, rents, etc.		723 70
E.—Total		$23,942 17
From public funds—		
J.—Tax levy for interest	27,960 00	
Tax levy for bonds	10,000 00	
		37,960 00
		$61,902 17

DIVISION II.

From fixed rates—		
L.—Domestic	$13,538 75	
M.—Manufacturing	406 00	
N.—Total		$13,944 75
From meter rates—		
O.—Domestic	3,536 53	
P.—Manufacturing	5,737 19	
Q.—Total		9,273 72

EXPENDITURES.

A. A.—Management and repairs	$10,781 49	
B. B.—Interest paid by tax levy	27,960 00	
Interest paid by water works	540 00	
C. C.—Total maintenance for year		$39,281 49
Bond paid by tax levy	10,000 00	
Bills payable paid by water works	4,500 00	
		14,500 00
D. D.—Balance to construction		8,120 68
		$61,902 17

Construction.

R.—Balance from previous years	$ 6,822 24	
Balance from maintenance	8,120 68	
Temporary loan city fund	10,000 00	
Bills payable	11,629 73	
		$36,572 65

F. F.—Extension of mains	$29 924 98	
H. H.—Water meters	346 28	
I. I.—Total for construction		$30,271 26
J. J.—Balance		6,301 39
		$36,572 65

W.—Net cost of works to date	$ 477,845 77
X.—Bonded debt	337,000 00
Bills payable	20,629 73



TWENTIETH

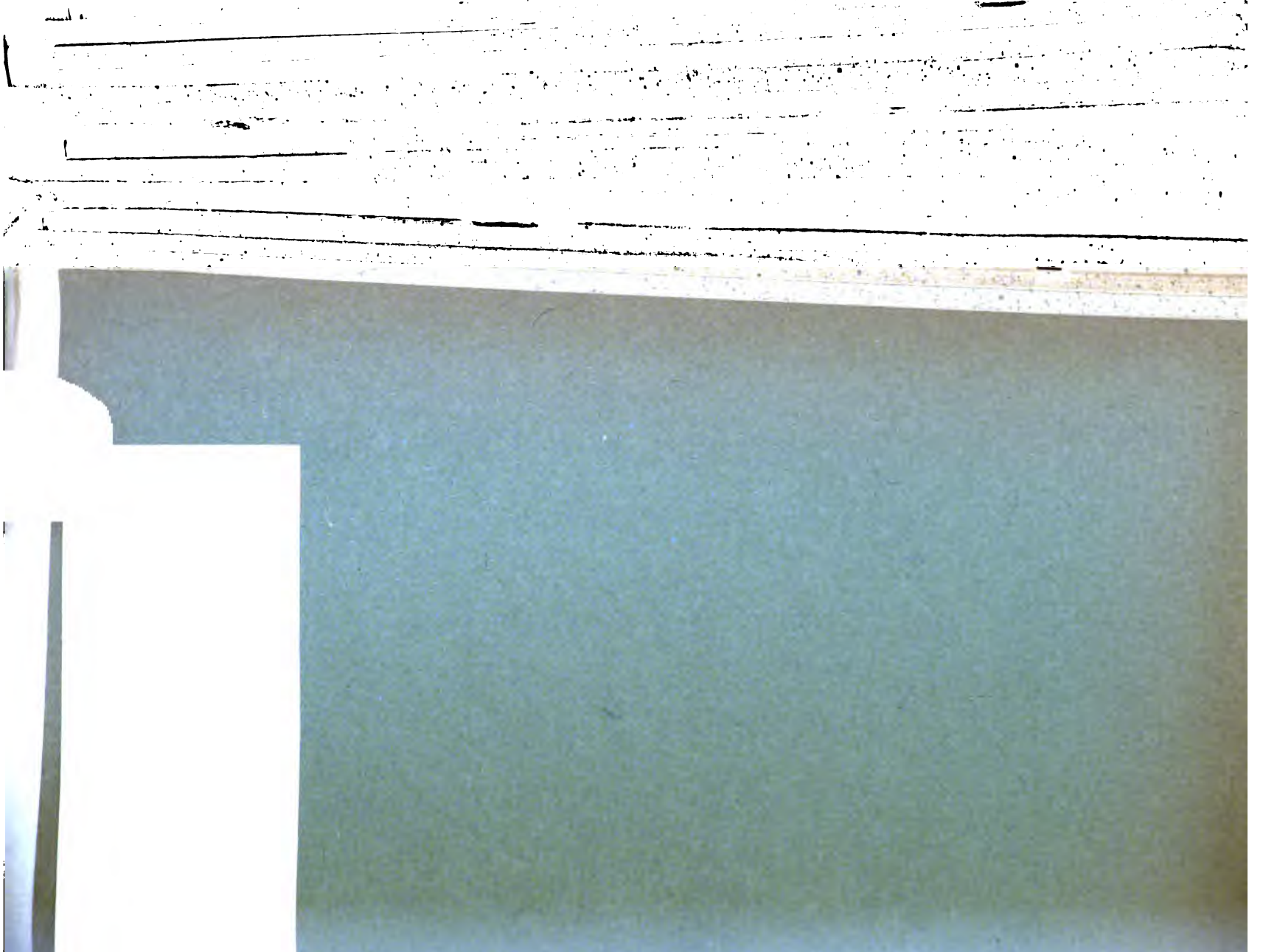
ANNUAL REPORT

OF THE

Superintendent of Water Works

BAY CITY, MICHIGAN.

1891.



TWENTIETH

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BAY CITY, MICHIGAN.

WATER DEPARTMENT

DECEMBER 31st, 1891.

COMMISSIONERS.

ANDREW WALTON, PRESIDENT.
(Term expires Sept. 6th, 1894.)

G. HENRY SHEARER.
(Term expires Sept. 6th, 1895.)

BENJAMIN F. RAY.
(Term expires Sept. 6th, 1896.)

SANFORD V. WILKIN.
(Term expires Sept. 6th, 1897.)

LOUIS MORITZ.
(Term expires Sept. 6th, 1898.)

DUNCAN McGREGOR.
(Term expires Sept. 6th, 1892.)

FREMONT J. TROMBLEY.
(Term expires Sept. 6th, 1893.)

SUPERINTENDENT'S REPORT.

To the Honorable Board of Water Commissioners of Bay City, Michigan:

GENTLEMEN: I have the honor to submit the Twentieth Annual Report of the Water Works Department of Bay City, the same being for the year ending December 31st, 1891.

Commissioner Selwyn Eddy, having been elected Alderman of the Third Ward, resigned his office as Commissioner of Water Works on the 27th day of April, 1891, and at the session of the Common Council held on that date, Mr. Sanford V. Wilkin was appointed to fill the vacancy caused thereby. His term of office will expire Sept. 6th, 1897.

The term of office of Commissioner Louis Moritz expired on the 6th day of Sept., 1891. At a session of the Common Council held Sept. 7th, 1891, Mr. Moritz was re-appointed; his term of office will expire Sept. 6th, 1898.

At the regular meeting of the Board of Water Works, held December 29th, 1891, Commissioner Andrew Walton was re-elected President of the Board for the ensuing year, and E. L. Dunbar re-appointed Secretary.

The past year's experience has thoroughly demonstrated the necessity for prompt action in the direction of increasing the supply from the Bay, or reducing the quantity of water pumped, unless the city is to use river water a considerable portion of the time. The constantly increasing demand upon the works, together with the continued lowering of the water-level in the lakes, thereby diminishing the capacity of the inlet pipe to supply the demand, compells an increased use of the direct supply from the river each year. Aside from the 25 days in September, during which it was necessary to use river water exclusively on account of a break in the inlet pipe from the bay, the river supply was in use in conjunction with the supply from the bay 513 hours and 35 minutes, as compared with 311 hours and 16 minutes in 1890. During the month of

June—when the demand upon the works was larger than other month since the works were started—the river s was open a portion of 23 days; the length of time the valve was open during the month mentioned being 181 h or more than one-fourth the entire time, and during the ba of the month, as well as most of the time through the sum the pipe from the bay was running to very nearly its full city to supply the demand for ordinary uses. On th day of September, about 11 p. m., the water from the bay denly ceased to flow into the wells at the pumping station it was necessary at once to turn on the full supply fro river. Your superintendent was in Cincinnati at the closing the iron pipe contract, and the source of the t was not located until his return two days later. The was first located approximately by lowering the water i wells at the pumping station, when an examination water level in the man-holes on the pipe placed it bet man-holes No. 2 and 4 (No. 3 being inaccessible). careful examination of the ground between these two disclosed a heavy depression in the midst of a large bo shingle wood in the mill yard of Mr. J. R. Hall, about 10 west of man-hole No. 3. The nature of the grou this place (quicksand) at once determined the probable acter of the break, and the fact that its repair would be a ous and expensive work. Men and teams were at once work removing the wood, nearly 200 cords of which had re-piled before the work of excavation could be prosecut advantage. When the pipe was reached it was found th section of pipe, about eight feet in length, had collapsed staves forming the upper half of the pipe having gone and the sand had been drawn into the pipe in sufficient tity to completely close it to the top. The cause of the was apparent. The pipe had evidently been settling round for years, until its horizontal diameter was full inches greater than its vertical The edges of all the

hat had fallen in, except the two upper ones, showed that hey had rested against each other their full thickness (three nches), but the two upper ones showed a bearing surface on heir outer edge only about one-fourth of an inch wide, and hese staves, before the pipe collapsed, must have lain in ıearly a horizontal position transeversely. At the time the ›reak occurred a heavy rain was falling, and the weight of the ;aturated sand, together with the heavy body of green wood vas too much for the slight arch formed by the pipe staves n their disabled condition, and they went down.

The removal of the sand which had passed into the pipe ınd had been carried towards the pumping station by the cur-ent of water, when the break first occurred, and before the ›ipe was entirely filled, was the most difficult and dangerous ›art of the work, but was finally accomplished without taking ›ut more of the pipe, and the supply was turned on again on he 26th of September.

The pipe put in place of the collapsed section was nade of 5-16th boiler iron, with flanged ends, the pipe being ›f the same interior diameter as the outside of the old pipe—36 inches. Short flanged sections were fitted over the adja-cent pipes, and the flanges bolted together with ⅝ bolts, with-›ut packing. A careful examination of the pipe as far as practical, each way from the break, showed that throughout his quicksand bed it had settled considerably out of round, ›eing in many places fully four inches larger in diameter hori-zontally than vertically, and, while it may stand up for years, a similar accident may happen at any time. This pipe has now been laid about 18 years, and shows no signs of decay, except a slight surface rot on the upper inner surface. It is good for a generation, except for accidents similar to the above described, and which are possible on only about 1,500 feet, where the pipe is laid in sand. This portion can only be made secure by bringing it back to its original form and securing it there by a system of lateral bracing, without taking up the

pipe, but it will be necessary to remove the covering, the pipe lies at a depth of from 18 to 20 feet below the the expense will be considerable. It will also be nece remove and replace a portion of the salt block at the r R. Hall, a part of which is built directly over the p would be necessary to take the entire city supply f river while the work is being done.

The meter system is not being extended as fast sirable. Nearly every meter set during the past year h on new services and not nearly all of these have been ed. The *reckless* and *absolutely useless* waste of w many of the unmetered services is enormous, as is sh an average daily pumpage of more than 1,500 gallons service, while the daily average for each metered se only a little more than 1,000 gallons per day and these all of the large manufacturing establishments, and draulic elevator which uses alone about 75,000 gal day. The average of the metered domestic services than 500 gallons per day, and these include the princip and the largest class of dwellings, where water is much larger quantities than can legitimately be use average of the unmetered services. Could the uses water through the services now not metered be reduced the average of the metered domestic services, the to pumpage would be reduced nearly 50 per cent, and sti a liberal quantity for public uses, and there would be casion for calling upon the river supply except in ca very large fire, or accident to the inlet from the bay.

If this were done there would be some encourage improve the present inlet works and extend the prese pipe into the Bay, thereby improving the quality of su some extent and enabling the works to furnish wate will be reasonably free from dangerous contaminati such times as the City can better afford to construct a n There is no question however but the best water ca

ıred from the west shore of the Bay and it is only a question time when the City supply will be drawn from that section. oney expended on the permanent improvement of the pres-ıt works is to a certain extent thrown away except for the ıefit derived while these works are in use and the amount be expended in this direction should depend upon the length time they are to be maintained. The placing of meters)wever, is not dependent upon any such contingency, as the eters are always worth all they cost in the saving of wear ıd tear on machinery and the increased efficiency of the ser-ce even if the quantity of the supply is unlimited.

The cost of attaching meters to all service would involve ıe expenditure of at least $15,000, but much could be accom-ished with an outlay of $5,000, which would meter most of ıe services where water closets and lawn hose are in use, and large percentage of the waste is in their uses. The expense f metering would be considerably reduced by permitting but ne service to a single block or tenement owned by one person r firm, and requiring the owner to pay the rates on the prem-es, except for elevators or other large consumers which ould require a special meter.

As stated in the last annual report of this department, 50,000 in bonds was voted by the people at the election in lovember, 1890, the proceeds to be used towards defraying ıe expense of laying certain lines of pipe for improving the ıpply to the south end of the city. It was also proposed to ıbmit to the people at the election in April, 1891, the question f issuing an additional $50,000 to complete this work as con-:mplated. Before the vote was taken this amount was reduc-d to $25,000 and the question of issuing this additional mount being submitted to the electors was carried by a vote of ,454 for and 210 against. As nothing had been done towards ısuing the bonds voted in 1890, at a session of the Common Council held May 11th, 1891, the entire $75,000 were ordered ıssued and negotiated.

The bonds were to be dated May 1st, 1891, ar payable, $25,000 in 15 years, $25,000 in 20 years, in 26 years, and $12,500 in 27 years from that date, at five per cent. per annum, payable semi-annually bonds were issued in accordance with the said resolut negotiated with W. J. Hayes & Co., of Cleveland.

As $22,000 of the proceeds of these bonds was re pay indebtedness incurred in 1890, on account of the i ment mentioned,—$10,000 to repay loan from liquor and $12,000 to pay orders issued to the Michigan P for pipe valves and hydrants,—there was left $53,000 plete the cast iron main pipe from the pumping st South Center street. This amount not being suffi cover the estimated cost of the entire work, it was de let contracts only as far as 23rd street, and under dat gust 1st, 1891, proposals were invited for the necess and special castings. Nine bids were received. T tract being awarded to the Addyston Pipe & Steel Co. cinnati, the lowest bidders, at $20.75 per ton for strai and $39.80 per ton for special castings. This contract ed in a very satisfactory manner, the last car load of ing delivered December 18th, and not a broken or casting has been found in the entire shipment. Nea thirds of the 20 inch pipe is laid and has been fully in since it was connected with the main in Second str cember 22nd.

The contract for trenching and back filling was to S. J. Perry & Co., and the pipe laying is done by da

The amount expended on this work to date is $3 and about $4,500 more will complete the pipe to the 23rd and Bowery. This will leave nearly $14,000 to the line to South Center street.

The size of this pipe is 20 inch from the pumpin to Tenth street and 16 inch from Tenth to Twe street.

The estimated cost of a 16 inch pipe from the corner of Twenty-Third and Bowery to the corner of South Center and Harrison street is $16,500, and for a 12 inch pipe between the same points is $12,500.

The original plan contemplated a 12 inch pipe south of 23rd street, but did not propose the removal of the old 10 inch pipe on Water street.

In view of the low price at which pipe is being procured, thereby placing the cost almost within the appropriation, and the fact that a 16 inch pipe will give a considerable larger supply than the 12 inch and 10 inch together, it is recommended that the pipe be continued 16 inches in diameter to South Center street, the route to be on 23rd street from Bowery to Water street, thence south on Water and Harrison streets. The old 10 inch and 8 inch pipe on these two last mentioned streets to be taken up, and if found in suitable condition relaid in some other street in that part of the city. The contract for the pipe should be let as soon as practicable for delivery in May or June.

Petitions have been before the board during the year for the following described lines of pipe which have not yet been laid:

An extension to the corner of Twelfth and Trumbull streets.
On south side Third street, from Trumbull to Park avenue.
On Naboabish avenue, from Park avenue to Annie street.

Other petitions are still in abeyance before the Board, as follows:

Campbell street, from Sherman to Sheridan street.
Sheridan street, from Campbell to Woodside avenue.
Fourth avenue, from Trumbull to Park avenue.
Fifth avenue, from Trumbull to Park avenue.
Jackson street, from Tenth to Eleventh street.
Monroe street, from Thirteenth to Sixteenth street.
Madison avenue, from Thirteenth to Twenty-second street.
Thirteenth street, from Sherman to Lincoln avenue.
Lincoln avenue, from Twelfth to Thirteenth street.

In addition to the lines of pipe above mentioned, the following have been recommended as urgently demanded:

Farragut street, from Second to Center avenue.
Sheridan street, from Second to Tenth street.
Michigan avenue, from Twenty-fifth to Fremont avenue.

As only a limited portion of this pipe can be laid the present year, a careful examination should be mad ordering any of them, and such lines selected for im construction as appear to be most necessary.

There is at present no section of the City more in better fire protection than that part of the First Ward l tween Belinda street on the east, Woodside avenue south, Henry street on the west and Campbell street north. This section would be fairly well protected by on Campbell street from Sherman to Sheridan street pipe on Sheridan street, from Campbell str Woodside avenue. The requirements of the Ward have been partially met by the pipe on Van street laid this year but suitable protection will not be that section of the City until the pipe is laid in Madison from 13th to 22nd streets. The attention of the Board directed to that part of the City between Sherman str Johnson street, between Second and Tenth street which idly filling up with a class of dwellings in which a su water from the water works is a necessity. Several in this section are without main pipes, and owners of they build are compelled to lay long lines of pipe t streets at their own expense to secure an adequate su water.

The amount of cash collections made by the dep during the year show an increase over the year $1,407.59 the increase in amount collected from wat being $1,294.02. The amount charged water rates 1891 exceeds the amount charged on roll of 189 $1,400.00.

The unsatisfactory condition of the supply duri latter part of the year is responsible for the fact of there more than 400 services shut off at the close of the year a ward of $500,00 on the Roll of 1891 uncollected.

FINANCIAL.

RECEIPTS.

The total receipts of the department during the year, from all sources not including amount received from sale of city bonds, was $25,349.76, from the following accounts:

Water rates, roll of 1884	$ 1 25	
Water rates, roll of 1885	2 25	
Water rates, roll of 1886	4 00	
Water rates, roll of 1887	7 50	
Water rates, roll of 1888	4 50	
Water rates, roll of 1890	102 97	
Water rates, roll of 1891	*24,390 02	
Total from water rates		$24,512 49
Plumbers' Licenses	$ 55 00	
Rent of boom	200 00	
Service connections	468 38	
Repairs on main distribution	108 89	
Repairs on services	5 00	
Total from miscellaneous		837 27
		$25,349 76

These receipts have been deposited with the City Treasurer as follows:

January 31st, 1891	$ 1,460 56
February 28th, 1891	1,027 75
March 31st, 1891	1,569 04
April 30th, 1891	2,195 67
June 1st, 1891	981 02
June 30th, 1891	*1,887 17
July 31st, 1891	3,084 92
August 31st, 1891	1,469 67
October 1st, 1891	1,739 65
November 2nd, 1891	2,714 18
November 30th, 1891	1,016 66
December 31st, 1891	6,203 47
	$25,349 76

*Does not include $9.00 water rates returned to consumers in June.

In addition to the above receipts of the Water Works department, the City Comptroller has deposited with the City Treasurer, to be placed in the Water Works fund, $75,000, proceeds of Water Works bonds sold. The premium received on said bonds, amounting to $3,750 being deposited in the General Fund.

The total amount of water rates charged on the 1891 was $24,905.40, an increase of $1,404.78 over t 1890. These rates were charged for:

Water supplied at fixed or schedule rates $14,
Water supplied through meters..... 10,
Water supplied for building purposes.....

The amounts collected were:

From fixed or schedule rates.....$13,
From metered water..... 10,
From building purposes .....

The amount uncollected:

From fixed or schedule rates.....$
From metered water.....
From building purposes .....

The total amount collected and uncollected on eac roll since the works commenced operations is as follow

YEAR'S ROLL.	COLLECTED.	UNCOLLECTED.	Tot
1873 Jan. 1st to April 30th, 1873	$ 728 82	$	
1873-4 May 1st 1873 to April 30th, 1874	5 440 80	1 60	
1874-5 May 1st 1874 to April 30th, 1875.	6,908 16	44 85	
1875 May 1st to Dec. 31st, 1875,.	7,369 55	28 46	
1876	9,571 26	82 73	
1877	9,604 26	134 19	
1878	10,078 15	324 71	
1879	11,708 97	136 07	
1880	13,155 74	120 25	
1881	14,996 61	218 40	
1882	17,352 47	158 85	
1883	18,713 46	98 64	
1884	18,892 02	152 64	
1885	19,716 73	270 58	
1886	19,348 61	126 74	
1887	19,435 25	88 00	
1888	21,260 78	138 64	
1889	22,118 45	115 05	
1890	23,267 66	231 96	
1891	24,390 02	515 38	
	$229,957 77	$2,968 74	$

EXPENDITURES.

The expenditures of the Department during the ye been $72,243.07, for the following accounts:

FOR MAINTENENCE ACCOUNTS:

Office Department:

Salaries.....$ 2,520 00
Expenses..... 438 71

Street and Service Department:		
Repairs on main distribution	$ 752 78	
Repairs on services and shutting off	361 65	
Repairs and care of water meters	312 94	
Repairs and care of inlet works and pipe	1,002 65	
Service connections	185 49	
Pumping Department.		
Salaries of engineers and firemen	$ 3,680 00	
Fuel	1,930 50	
Oil, packing and supplies	262 06	
Repairs on engines and boilers	493 26	
Repairs on boiler arches	62 25	
Repairs on buildings, etc.		
Repairs to engine house and wells	$ 60 02	
Total Maintenence		$12,062 31
For Construction Accounts.		
Water Meters:		
Meters	$ 962 03	
Setting Meters	122 34	
Main Distribution.		
Iron pipe and branch castings	$28,718 35	
Wyckoff pipe	5,312 45	
Valves	1,767 00	
Fire Hydrants	605 50	
Laying iron pipe	4,716 37	
Laying Wyckoff pipe	1,017 15	
Total Construction.		$43,221 19
Bills Payable.		
Special orders No. 5, 6 and 7 to Mich. Pipe Co.	$11,629 73	
Special order No. 3 to The Holly Mfg. Co.	4,500 00	
Total bills payable		$16,129 73
Interest.		
Interest on special orders 5, 6 and 7	$ 469 84	
Interest on special orders 3 and 4	360 00	
Total interest		$829 84
Total expenditures		$72,243 07

In addition to the above expenditures by the Board $10,000,00 has been transfered by order of the Council from the Water Works Funds to other City Funds to repay loan to the Water Works Fund from those Funds made in 1890 to

assist this department in laying certain lines of pipe prove the supply to the south end of the City. Specia No. 5, 6, and 7 above mentioned were issued Michigan Pipe Co., for material used for the same These orders with the interest thereon and the said $1 loan were paid from the proceeds of the $75,000,00 cit sold.

The account with the $75,000.00 bond issue st follows:

Received from sale of bonds		$75,0
Paid temporary loan from City Fund	$10,000 00	
Paid special orders No. 5, 6 and 7	11,629 73	
Paid interest on said orders	469 84	
Paid Addyston Pipe and Steel Co.	28,512 38	
Paid delivering pipe on street	540 80	
Paid laying pipe	2,740 09	
Paid lead and packing for joints	1,480 52	
Paid valves	1,241 50	
Paid hydrants	25 50	
Paid advertising for proposals, etc.	75 11	
Balance	18,284 53	
	$75,000 00	$75,0

The City Treasurer has paid from moneys raised levy the annual interest on the Water Works Bonds ou ing amounting to $28,835.00. $10,000.00 of the origin of Water Works Bonds have been redeemed with mon rived from the same source, being series No. 5, issued J 15th, 1872, payable October 15th, 1891.

WATER WORKS FUND AND CITY TREASURER.

The account with "City Water Works Fund" and the City Treasurer as Treasurer of the board stand as fo

WATER WORKS FUND.

To balance in fund January 1st, 1891	$ 6,301 39	
Cash collections deposited	25,349 76	
Proceeds of bonds sold	75,000 00	
By amount withdrawn on Recorder's warrants:		
January 31, 1891, warrant 264, statement 49		$ 93
February 27, " " 265, " 50		82

March	31,	"	"	266,	"	51.....	1,166 63
April	29,	"	"	267,	"	52.....	998 88
May	29,	"	"	268,	"	53.....	2,274 79
June	30,	"	"	269,	"	54.....	4,161 41
July	31,	"	"	270,	"	55.....	6,093 44
August	31,	"	"	271,	"	56.....	8,024 43
Septem'r	30,	"	"	272,	"	57.....	3,618 73
October	31,	"	"	273,	"	58.....	15,818 01
Novemb'r	30,	"	"	274,	"	59.....	14,572 78
Decemb'r	31,	"	"	275,	"	60.....	13,757 96
October		" Transferred to City Funds by order of Council.....					10,000 00
		Balance of Fund Dec. 31st, 1891.....					24,408 08
						$106,651 15	$106,651 15

Balance of $75,000.00 loan.....	$18,284 53	
Balance of General Water Works Fund.....	6,123 55	
		$24,408 08

ITY TREASURER AS TREASURER OF BOARD.

To Recorder's warrants No. 264 to 275 inclusive..	$72,243 07	
By paid orders drawn by Secretary, No. 1042 to 1400 inclusive		$72,243 07
	$72,243 07	$72,243 07

LEDGER BALANCES.

Balance of accounts for 1891.

DEBIT BALANCES.

:DGER D.			
)lio 270,	Office department, salaries.....	$	2,520 00
" 271,	" " expenses.....		438 71
" 277,	Street and service dep'tm't, repairs on main distribution		643 89
" 273,	" " " " service and shut off		356 65
" 274,	" " " " and care of meters..		312 94
" 275,	" " " " and care inlet works		1,002 65
" 278,	Pumping dep'tm't, salaries		3,680 00
" 279,	" " fuel		1,930 50
" 280,	" " oil, packing and supplies.....		262 06
" 281,	" " repairs on engines and boilers.....		493 26
" 281,	" " repairs on boiler arches		62 25
" 282,	Repairs on buildings, etc., repairs to engine house.....		60 02
" 284,	Interest		829 84
" 284,	Bills payable		16,129 73
" 285,	Water meters		1,084 37
" 286,	Main distribution, iron pipe and branches.....		28,718 35
" 286,	" " Wyckoff pipe		5,312 45
" 287,	" " valves		1,767 00
" 287,	" " fire hydrants		605 50

"	288,	"	"	laying Wyckoff pipe..
"	289,	"	"	laying iron pipe
"	317,	Bay City loan from City Fund		
"	257,	Water Works Fund		

CREDIT BALANCES.

Folio	265,	Water rates roll of		1891
"	266,	"	"	1890
"	267,	"	"	1888
"	267,	"	"	1887
"	267,	"	"	1886
"	268,	"	"	1885
"	266,	"	"	1884
"	269,	Plumbers' licenses		
"	269,	Rents, dockage, etc.,		
"	276,	Service connections		
"	291,	Bay City Bond account		

BALANCE OF ALL ACCOUNTS FROM JANUARY 1st, 1872:

DEBIT BALANCES.

LEDGER D.

Folio	439,	Water Works Fund	$ 24,408 08
"	440,	Real Estate	6,724 83
"	440,	Docks, tramways and store shed	1,882 63
"	441,	Engine house, chimney and wells	19,097 42
"	441,	Engine & boiler foundations & arches	5,881 87
"	442,	Pumping machinery	57,673 05
"	442,	Inlet from Saginaw river	3,218 99
"	443,	Inlet from Saginaw bay	84,778 37
"	443,	Reservoir, breakwater, etc., at bay	24,713 78
"	444,	Iron pipe and branch castings	89,781 07
"	444,	Wyckoff patent pipe	123,666 14
"	445,	Valves for street mains	14,113 61
"	445,	Public fire hydrants	12,438 59
"	446,	Laying pipe	48,507 19
"	446,	Buildings at bay	452 46
"	447,	Water meters	13,016 76
"	447,	Furniture and fixtures	990 96
"	448,	Implement account (construction)	1,713 61
"	448,	Engineer'g and gen'l sup't, (const'n)	7,856 17
"	449,	Traveling expenses, (construction)	306 29
"	449,	Insurance expenses, (construction)	29 00
"	450,	Interest, discounts & com'ns, (const'n)	4,224 17
"	451,	Office expenses and salaries	42,104 11
"	451,	Repairs & care hydrants, valves & pipes	12,199 27
"	452,	Repairs and care water meters	1,768 70
"	452,	Repairs and care inlet works and pipe	9,765 43
"	453,	Repairs to engine house	1,252 93
"	453,	Repairs to dock	13 38
"	454,	Engineers' and firemen's wages	66,670 84
"	454,	Fuel	49,530 63
"	455,	Oil, packing and engineers' supplies	7,495 21

Folio 455,	Repairs to pumping machinery	$ 5,774 37
" 456,	Repairs to engine foundations	51 46
" 456,	Repairs to boiler arches	1,005 15
" 457,	Implements and tools, (repairs)	1,129 37
" 457,	Interest	3,529 84
		$747,765 73

CREDIT ACCOUNTS.

Folio 430,	Bay City bond acc't, $452,000.00 bonds	$443,045 87
" 430,	Water assessment, frontage on pipe	736 07
" 431,	Bills payable	4,500 00
" 432,	Water rates rolls from 1872 to 1882	106,814 79
" 432,	Water rates, roll of 1883	18,713 46
" 433,	Water rates, roll of 1884	18,892 02
" 433,	Water rates, roll of 1885	19,716 73
" 434,	Water rates, roll of 1886	19,348 61
" 434,	Water rates, roll of 1887	19,435 25
" 435,	Water rates, roll of 1888	21,260 78
" 435,	Water rates, roll of 1889	22,118 45
" 436,	Water rates, roll of 1890	23,267 66
" 436,	Water rates, roll of 1891	24,390 02
" 438,	Plumbers' License	612 70
" 438,	Rents, Dockage, etc	2,187 33
" 439,	Service taps and stop boxes	2,725 99
		$747,765 73

WATER WORKS BONDS OUTSTANDING DECEMBER 31ST, 1891.

Series.	Date of Issue.	When Payable.	Amount.	Interest.
No. 6	January 15, 1872	October 15, 1892	$ 10,000 00	8 per cent.
" 7	" " "	" " 1893	10,000 00	" " "
" 8	" " "	" " 1894	10,000 00	" " "
" 9	" " "	" " 1895	10,000 00	" " "
" 10	" " "	" " 1896	10,000 00	" " "
" 11	" " "	" " 1897	10,000 00	" " "
" 12	" " "	" " 1898	8,000 00	" " "
" 13	August 15, 1872	Febr'y 16, 1899	10,000 00	" " "
" 14	" " "	" " 1900	10,000 00	" " "
" 15	" " "	" " 1901	10,000 00	" " "
" 16	" " "	" " 1902	10,000 00	" " "
" 17	" " "	" " 1903	10,000 00	" " "
" 18	" " "	" " 1904	9,000 00	" " "
" 19	" " 1873	" " 1905	10,000 00	" " "
" 20	" " "	" " 1906	10,000 00	" " "
" 21	" " "	" " 1907	10,000 00	" " "
" 22	" " "	" " 1908	10,000 00	" " "
" 23	" " "	" " 1909	10,000 00	" " "
" 24	Febr'y 15, 1874	" " 1910	10,000 00	" " "
" 25	April 15, 1874	April 15, 1911	10,000 00	" " "
" 26	" " "	" " 1912	10,000 00	" " "
" 27	" " "	" " 1913	20,000 00	" " "

No. 28	October	15,	1874	October	15, 1894	$10,000 00
" 29	"	"	"	"	" 1895	10,000 00
" 30	"	"	"	"	" 1896	10,000 00
" 31	"	"	"	"	" 1897	10,000 00
" 32	"	"	"	"	" 1898	10,000 00
" 33	March	1,	1875	March	1, 1900	10,000 00
" 34	"	"	"	"	" 1901	10,000 00
" 35	June	1,	1875	June	1, 1902	10,000 00
" 36	"	"	"	"	" 1903	10,000 00
" 37	"	"	"	"	" 1904	10,000 00
Not Seried.						
1 to 25	May	1,	1891	May	1, 1906	25,000 00
26 to 50	"	"	"	"	" 1911	25,000 00
51 to 63	"	"	"	"	" 1917	12,500 00
64 to 76	"	"	"	"	" 1918	12,500 00
						$402,000 00

INTEREST BEARING ORDERS OUTSANDING DECEMBER 3

Order.	Date of Issue.	When Payable.	Amount.
No. 4	November 1, 1886	November 1, 1892	$ 4,500 00

SOURCE AND SUPPLY.

The supply direct from the river has been drawn
times during the year, of which 21 only were for fire p
The total length of time the river valve was open w
to 46 days, 5 hours and 35 minutes, of which 24 days
hours were on account of the break in the inlet pipe, h
fore mentioned, and during which time the entire sup
taken from the river; 22 hours and 55 minutes was to
demand for fire service, and 20 days 10 hours and 40
the demand for ordinary uses exceeded the capacity
inlet pipe from the bay.

The spring freshet of 1891 was of very moderate ex
its effect upon the waters of the bay was of short d
The water in the bay began to clear up early in May,
dry weather in May and June caused an excessive
upon the works, and the almost daily use of river wa
not permit any improvement in the water in the dist
pipes.

As flushing the pipes in the city would only increase the use of river water without material benefit, this work, which is usually done in the spring as soon as the water clears up in the bay, was deferred until the rains which commenced the latter part of June had reduced the consumption to a point when the use of river water was seldom necessary. After the mains were flushed the quality of the supply was exceptionally good, until the break in the inlet pipe compelled the use of river water, and by the time this was repaired the heavy rains had caused an excessive discharge from the river, and the water along the east shore of the bay assumed the condition usual after the spring freshet. No more clear water was obtained until after the bay froze over in December.

The extended use of river water followed as it was by a large number of cases of typhoid fever in the city, many of which were in families taking their water supply for domestic uses from the water works, has caused a feeling of prejudice against the city supply which, while largely conjectural is almost universal, and will not be removed until such action is taken as will obviate the necessity of using river water except under extraordinary circumstances.

The amount expended during the year in the repairs and care of inlet works and pipes was $1,002.65.

For salary of Reservoir Keeper	$ 420 00
Extra work at the bay	7 00
Tools used at the bay	2 82
Repairs on river inlet	75
Repairing break in inlet pipe from bay	572 08
	$ 1,002 65

PUMPING STATION.

The pumping engines are in good condition and show very little wear. All of them are capable of running to their full capacity in case of necessity. No expensive repairs have been required on either of them during the year. The repairs on the Gaskill engines consist of one set of bronze boxes for the main bearing, and several new gibbs in the connections.

The quadruplex engines have required no repairs o
what was done by the engineers in charge.

The galvanized iron exhaust pipe from the high
engines to the smoke stack rusted through in severa
and new sections have been put in where it gave out.

The expenditures during the year for repairs on t
ing engines were:

For repairs on Gaskill engine	$
For repairs on high pressure exhaust	
For paint and varnish	
For repairs on feed pumps and feed pipes	
	$

The boilers are in fully as good condition as a y
No extensive repairs have been required on any exce
The back head of this boiler has shown a slight frac
tween two of the flues for some time, but not sufficie
tract attention from the inspector, it standing the hy
test without leakage, but every time the boiler was
after being cooled down there would be a slight
around the flues adjoining the fracture, which beca
and more difficult to make tight. A new steel head
in and the flues in the boiler thoroughly cleaned
places it in first class condition. The inspector repor
boilers in good condition, Nos. 1 and 3 clean and No
heavy scale in the flues; this we think can be taken
out taking out the flues.

The cost of repairs to the boilers was:

For new head in No. 1 boiler and cleaning flues	$
For repairing No. 2 boiler, caulking flues and patch	
For new grate bars	
	$

The Insurance company has repeatedly recomm
the board the placing of two additional boilers in th
instead of replacing any of the old boilers at present
ones. It would be impossible to run all of the pum
gines to their full capacity with the present boiler

and in case of accident to either of the old boilers it would place the works in a seriously crippled condition to supply the demand for a large fire, but to put in additional boilers involves the expense of an addition to the boiler room, and it rests with the board to determine whether the exigencies of the case as yet demand this expenditure.

The repairs of boiler No. 1 involved the tearing down and rebuilding a considerable portion of the arch which cost $62.25 in addition to the cost of the repairs to the boiler as given above.

The contract with Dolsen, Chapin & Co. for furnishing fuel for operating the works was extended over another year at the same price to wit: 35 cents per cord for mixed slabs and edgings piled on the yard at the pumping station. At the commencement of the year there was 1,353½ cords of wood on the Water Works yard of the cut of 1890; 249 cords of this wood was returned to Dolsen, Chapin & Co., leaving 1,104½ cords of this wood consumed by the works; 2,540½ cords of the cut of 1891 were delivered on Water Works yard, of which 1,865½ cords have been paid for, leaving 675 cords on the yard not paid for. Total quantity of wood paid for during the year 2,970 cords, and total number of cords burned, 2,042, an increase of 120 cords over the year 1890. This increase is due to the increased quantity of water pumped and the greater pressure carried for domestic use.

The dry weather which commenced in May and caused such a large consumption of water, so reduced the pressure in the business portion of the city that the water would not flow to the elevator tanks on the roofs of the buildings in sufficient quantity to supply the demand and from May 9th until the new main was connected on Second street December 22nd, the pressure from 6 a. m. until 6 p. m. was carried at 50 lbs. instead of 45 lbs. as before. Since the new main was connected the pressure is carried day and night at 40 lbs. and no

trouble is experienced in supplying the water at any elevation,

The Gaskill engines have been run during the year hours and 25 minutes.

The Quadruplex engines have been run 82 hours minutes.

The High pressure engines and rotary pumps 13 hou 10 minutes.

The longest continuous run of the Gaskill engine w July 6th to September 23rd, 78 days.

	Gallon
Quantity of water pumped by the Gaskill engines was	1,002,468
Pumped by Quadruplex engines	11,389
Pumped by rotaries	617
	1,014,475

Of which 1,002,824,048 gallons were pumped agai average domestic pressure of 45 lbs. per square inch an 650,936 gallons against an average fire pressure of 84 lbs. per square inch.

The greatest quantity of water pumped in one da 4,090,526 gallons, June 7th, and the least quantity pum one day was 2,156,341 gallons, December 27th.

The average dynamic head for all water pumped w feet.

The total amount paid for running the pumping engin $6,428.07 and the net cost of running the engines was:

For engineers' and firemen's wages	$ 3,68
For fuel burned	1,91
For oil, packing and supplies used	28
For repairs on engines and boilers	49
For repairs on boiler arches	6
	$ 6,43

Cost per million gallons pumped	$	6 34
Cost per million gallons raised 100 feet		5 07
Cost for fuel per million gallons pumped		1 88 5-10
Cost for fuel per million gallons raised 100 feet		1 51

Duty based on one cord wood equal 550 lbs coal—1,618,100 lbs e

$$\frac{1,014\,475,024 \times 8.34 \times 100 \times 114}{1,618,100.} = 65,360,000.$$

WATER PUMPED, 1891.

MONTHS.	GASKILL ENGINES.			QUADRUPLEX ENGINES.			ROTARIES.			TOTALS.		FIRES.					
	Hours Run.	Revolutions.	Gallons Pumped.	Hours Run.	Revolutions.	Gallons Pumped.	Hours Run.	Revolutions.	Gallons Pumped.	Gallons Pumped.	Daily Average.	No. Alarms.	Hours Run.	Highest Pressure.	Lowest Pressure.	Average Pressure.	Gallons Pumped.
January	741.40	687,138	88,143,698	3 17	8,184	450,120	.....	.....	.....	88,593,818	2,696,575	5	4 27	110	90	92	801,108
February	659.30	604,116	78,098,066	12.15	30,179	1,659,845	4.50	12,204	207,468	74,965,349	2,677,334	6	1.24	90	80	84	241,637
March	735.50	678,047	82 043,687	8 10	21,354	1,174,470	.....	.....	.....	83,218,157	2,684,457	13	10 32	105	70	86	1,830,004
April	717.50	636,247	76,985,887	2.10	5,198	285,890	.....	.....	.....	77,271,777	2,575,726	12	4.16	90	80	85	806,102
May	734.40	714,825	86,493,825	9.20	26,050	1,432,750	.....	.....	.....	87,926,575	2,836,341	23	12.23	90	80	84	2,266,572
June	708.50	820,120	99,234,520	11.10	27,891	1,534,005	7.40	21,632	367,744	101,136,269	3,371,209	14	9.46	100	80	88	2,075,634
July	743.20	756,764	91,568,444	.40	1,504	82,720	.40	2,479	42,143	91,693,307	2,957,849	8	3 09	90	70	83	567,006
August	744.00	764,827	92,544,067	.....	.....	.....	.....	.....	.....	92,544,067	2,985,292	10	3.55	90	70	78	654,731
September...	718 10	699,009	84,580,089	1.50	5,516	303,380	.....	.....	.....	84,883,469	2,829,449	8	2.29	90	80	89	436,447
October.....	716.40	667,111	80,720,431	27.20	66.309	3,646,995	.....	.....	.....	84,367,426	2,721,530	12	7.02	90	70	83	761,574
November...	713.55	687,257	77,108,097	6.05	14,890	818,950	.....	.....	.....	77,927,047	2,597,563	5	3.29	80	70	79	509,047
December ..	744.00	619,403	74,947,763	.....	.....	.....	.....	.....	.....	74,947 763	2,417,670	11	5 20	80	70	79	701,074
TOTALS.....	8,678.25	8,284,864	1,002,468,544	82,17	207,075	11,389,125	13.10	36,315	617,355	1,014,475,024	2,779,384	127	68 12	110	70	84 64	11,650,936



The total quantity of water pumped each year si works commenced operations is as follows:

1873	142,477,725	1883	773,94
1874	294,714,798	1884	831,86
1875	416,756,579	1885	836,97
1876	518,197,129	1886	779,76
1877	538,847,186	1887	827,19
1878	530,197,397	1888	872,99
1879	672,344,128	1889	944,47
1880	827,067,372	1890	988,77
1881	944,382,043	1891	1,014,47
1882	775,642,466		

PUMPING PLANT.

Boilers—Three horizontal return tubular boilers long, 5½ feet diametar of shell, 105 tubes of 2¾ inch terior diameter in each boiler, the boilers set in se brick arches; area of grate surface under No. 1 boil square feet; under No. 2 and 3 boilers each 34 squar Heating surface of each boiler (½ shell 138.24 square tubes 1,209.51 square feet) 1,347.75 square feet. Steam sure carried, 65 lbs.

Engines and Pumps—One Gaskill horizontal comp condensing crank and fly wheel pumping engine, max capacity 5,000,000 gallons in 24 hours. One Holly ruplex compound condensing crank and fly wheel pu engine, maximum capacity 3,000,000 gallons in 24 h One horizontal high pressure piston engine, driving th gearing two No. 10 Holly rotary pumps, maximum cap 2,500,000 gallons in 24 hours.

Capacity of Gaskill pumps per revolution, 121 gallon
Capacity of Quadruplex pumps per revolution, 55 ga
Capacity of Rotary pumps per revolution, 17 gallons.

MAIN DISTRIBUTION.

The distributing mains have been extended during the as follows:

A 6-inch Wyckoff pipe has been laid in Sherman street from Wis avenue to Tenth street with 7 fire hydrants.

A 6-inch Wyckoff pipe in Park avenue from Center avenue to Ridge road with 3 fire hydrants.

A 6-inch Wyckoff pipe in Lincoln avenue from Tenth to Twelfth street with 2 fire hydrants.

An 8-inch Wyckoff pipe in Van Buren street from Thirteenth street to Twenty-second street with 8 fire hydrants.

The 20-inch cast iron pipe is laid in Water street from the pumping station to Washington avenue and in Washington avenue from Water street to Second street, with 6-inch branches at each street intersection, and in the case of long blocks at intermediate points for connecting fire hydrants. On Water Works yard and at Belinda street the 6-inch pipes for hydrant connections are laid north about 500 feet for the purpose of locating fire hydrants near the river front for protection to the lumber docks near these points.

All of the material for the completion of this main pipe to Twenty-third and Bowery street except one 16-inch valve, and about 5 tons of lead is on hand and paid for.

For the purpose of connecting the lines of pipe above mentioned with main pipes already in the ground the following described pipes were taken out:

One section of 6-inch Wyckoff pipe in Woodside avenue at Sherman street.

One section of 6-inch Wyckoff pipe and one 6-inch cast iron branch in Twenty-second street.

18 feet of 10-inch cast iron pipe in Second street at Washington avenue.

Hydrant No. 233 set in 1890 in River street between South Center street and Thirty-eighth street was taken out to permit Bousfield & Co. to extend their warehouse, and as the arrangement of the railroad tracks at that point would not permit of its being reset in that vicinity, the pipe and valve between this hydrant and the main pipe were taken out, and the opening in the main plugged.

Total length of pipe laid during the year:

	20-inch.	10-inch.	8-inch.	6-inch.	4-inch.	Total.
Wyckoff pipe.....			3,072 ft.	7,274 8-12.	142 6-12.	10,489 2-12.
Iron pipe & branches	6,264 ft.	16-ft.	34 ft.	1,301 6-12.		7,615 6-12.
Total.....	6,264 ft.	16-ft.	3,106 ft.	8,576 2-12.	142 6-12.	18,104 8-12.

Length of pipe taken out during the year:

	10-inch.	6-inch.	4-inch
Wyckoff pipe		14 2-12.	15 ft
Cast iron pipe and branches	18 ft.	1 6-12.	
Total	18 ft.	15 8-12.	15 ft

Total number feet of distributing mains in use:

	20-in.	16-in	12-in.	10-inch.	8-inch.	6-inch.	4-inch.	3-in.
Wykf pipe	.....	.....	....	34,198 10 12	27,038 9-12	86,042 6-12	22,093 10-12	319
Iron pipe	6,408	1.467	9,083	8,702 8 12	2,078 5-12	2,322	786 3-12	.....
Totals	6,308	1.467	9,083	42,901 6-12	29,117 2-12	88,364 6-12	22, 80 1-12	319

Total Wyckoff mains ..... 32 miles 732 feet 11 in
Total cast iron mains ..... 5 miles 4,347 feet 4 in

Total ..... 37 miles 5,080 feet 3 in

The cost of the several lines of pipe laid during t
was as follows:

Sherman street from Woodside avenue to 10th street ..... $ 2,7
Park avenue from Center avenue to Ridge Road 1,3
Lincoln avenue from 10th to 12th 6
Van Buren street from 13th to 22nd 2,7
Expended on 20-inch and 16-inch cast iron main 34,6

Total amount expended on distributing main $42,1

VALVES.

The number, size and make of valves set during t
was as follows:

	20-inch.	10-inch.	8-inch.	6-inch.	4-inch.
Flower patent	3	2	3	29	20

And one 4-inch Flower valve was taken out.

Total valves in use in the distributing mains:

	20-in.	16-in.	12-in.	10-in.	8-in.	6-in.	4-in.	3-in.	Total.
Flower patent	3	2	3	33	41	126	296	5	509
Galvin patent	.....	.....	2	1	1	5	45	.....	54
Brown patent	.....	.....	1	.....	.....	1	.....	.....	2
Total	3	2	6	34	42	132	341	5	565

FIRE HYDRANTS.

The number of fire hydrants put in during the year was 20, all of the Mathews pattern made by R. D. Wood & Co.

One hydrant of the same pattern and make was taken out.

Total fire hydrants set and in use:

Holly pattern	131
Gaskill pattern	15
Mathews pattern	156
Galvin pattern	5
Brown pattern	1
Total	308

Two Mathews hydrants have crane attachment for filling street sprinkler carts.

All of the hydrants now in use are double discharge post hydrants with 4-inch inlet, 5 of the Holly hydrants have cut off gates at hose nozzle.

REPAIRS.

The number of leaks in the distributing mains during the year was 57 as follows:

DATE.	KIND OF PIPE.	LOCATION.	CHARACTER.	HOW REPAIRED.
Jan. 23..	4-in Wyckf.	Alley bet. Mon. & Jack. bet. 4th & 5th..	bands rusted off.	new pipe & slv
Feb. 10..	8 in "	Harrison street at 41st street.....	joint	plugged.
Mar. 21..	6-in "	Water street bet. 9th and 10th....	joint	plugged.
April 4..	4 in "	..Alley bet. Adams & Jeffer, bet. 8th & 9th	joint.....	plugged.
May 1..	8-in "	..Alley bet. Jefferson and Madison at 2nd.....	joint.....	plugged.
" 5..	4-in "	..Alley bet. Madison and Monroe at 10th..	joint.....	plugged.
" 6..	6-in "	..Park ave. north of 2nd street.....	knot hole.....	plugged.
" 6..	8 in "	..Thirteenth, bet. Bowery and Williams.... ...	jo nt.... ..	plugged.
" 8..	6-in "	..Water foot of Center ave.....	.bands rusted out..	new pipe & slv
" 21..	10-in "	..Water foot of Fremont avenue..	joint.....	plugged.
June 6..	8-in "	..Alley bet. Jef. & Madison bet. 4th & 5th...	bands rusted off..	new pipe & slv
" 8..	8-in "	..Harrison bet. 34th and 35th.....	joint...	plugged.
" 9..	8-in "	..Harrison bet. 34th and 35th	joint.....	plugged.
" 10..	4-in "	..Alley bet. Madison & Mon, bet 7th & 8th.	bands rusted off	new pipe & slv

"	24..	8-in	"	..Harrison at 40th street... .....bands rusted off..ne
"	30..	8-in	"	..Harrison bet. 33d and 34th..... joint.....pl
July	3..	8 in	"	..Alley bet. Jef. & Madison 2nd & 3rd.....joint.....pl
"	6..	8 in	"	..Eighteenth bet. Bowery and Williams..... .joint.....pl
"	7..	8-in	"	..Harrison at 35th street..... .....joint.....pl
"	11..	6-in	"	..McEwan north of Water street.....joint.....pl
"	15..	8 in	"	..Alley bet. Jefferson & Madison at 2nd...bands rusted off...ne
"	17..	4-in	"	..Park ave at 7th street... ... .joint.....ne
"	23..	4 in	"	..Alley bet. Washington & Adams at 10th.. ....joint .....pl
"	28..	4-in	"	..Alley bet. Wash. & Adams, 10th & 11th..bands rusted off..ne
"	28..	4-in	"	..Alley bet. Wash. & Adams 10th & 11th.....joint.....pl
"	30..	6.in	"	..Park ave. bet. Naboabish and North.....knot hole ....pl
Aug.	6..	10-in	"	..Water bet. 19th and 21st.... .....bands rusted off.ne
"	6..	10-in	"	..Water bet. 19th and 21st..... ....joint.....pl
"	10..	10-in	"	..Bowery at 21st.... .....joint.... pl
"	18..	6-in	"	..Alley bet. Wash. & Adams, Center & 6th..bands rusted off..ne
"	21..	4 in	"	..Alley bet. Adams & Jefferson 8th & 9th.....joint.....pl
Sep.	1..	4 in	"	..Alley bet. Adams and Jefferson at 8th..... .joint .....pl
"	5..	4-in	"	..Alley bet. Madison & Mon., Center & 6th.....knot hole.....pl
"	7..	8-in	"	..Harrison bet 34th and 35th.....joint..... pl
"	9..	8 in	"	..Harrison bet. 34th and 35th... .... joint.....pl
"	12..	4-in	"	..Alley bet. Sag & Washington, 6th & 7th.. ..... .joint.....pl
"	16..	10-in	"	..Water bet. 27th ank 28th.....bands rusted off...ne
"	28..	10-in	"	. Johnson bet. 1st and Woodside.....knot hole.....pl
Oct.	5..	8-in	"	..Harrison bet. 35th and South Center.... .....joint.....pl
"	5..	8-in	"	..Harrison bet. 35th and South Ce nter..... .....joint.....pl
"	6..	8-in	"	..Harrison bet. 35th and South Center.... .....joint.....pl
"	7..	8 in	"	..Harrsoin bet. 35th and South Center.....joint.....pl
"	7..	8-in	"	..Alley bet. Jefferson and Madison in 3rd...bands rusted off.ne
"	8..	6-in	"	..Water bet. 9th and 10th..... ...joint.....pl
"	8..	10-in	"	..Harrison bet. 31st and 32nd ....joint..... .pl
"	10..	10-in	"	..Belinda bet Woodside and Longtin.... ..... joint.....pl
"	12..	8-in	"	..Alley bet. Jefferson & Madison, 2nd to 3rd....sleeve joint ...n
"	27..	10-in	"	..Water bet. 19th and 21st..... .....bands rusted off..ne
"	27..	8-in	"	..Fremont ave bet. Webster & McCormick.....old plug.. ...pl
"	29..	10-in	"	..Water bet. 19th and 21st.....bands rusted off..ne
Nov.	4..	8-in	"	..Eighteenth bet. Bowery and Williams.....joint.....pl
"	12..	8-in	"	..Alley bet. Jefferson and Madison in 10th.....joint.....pl
"	24..	8-in	"	..Harrison bet. 34th and 35th.....joint.....pl
"	28..	6-in	"	..Water at 9th..... ....bands rusted off..ne
"	28..	6-in	"	..Water at 9th.....bands rusted off..ne
"	28..	6 in	"	..Water at 9th ....bands rusted off..n
"	28..	6-in	"	..Water at 9th..... ....bands rusted off..ne

The cost of repairing these leaks was $393.19, o
$277.41 was for labor, and $115.78 for new pipe and s

The 16-inch valve put in in 1886 on the discharg
from the Gaskill engines was closed in 1890 when the
plug blew out in front of the engine house and could n
fully opened. Its condition could not be determined w
tainty but it was known not to be fully open, and it c
neither opened or closed, as it was necessary to close t

before the 20-inch main was started, it was cut out and another valve put in in its place, when taken out it was found to be less than one-half open. It had been in this condition more than a year. The cost of making this change including the cost of the new valve was $93.50.

One 6-inch valve stem was broken and the thread strained on an 8-inch valve stem, these stems were replaced with new ones. Several valves have required repacking, and 8 of the old wooden valve boxes have been replaced with cast iron extension boxes. The cost of these repairs on valves was $65.90 which includes the cost of one 10-inch valve stem, one 8-inch valve stem, two 6-inch valve stems and two 4-inch valve stems bought and in stock ready for use in case of accident. Ten hydrants were found frozen during the months of February and March. One was found frozen by the city fire department when its use was required for fire purposes, and caused a slight delay in getting water onto a fire but no serious loss resulted. The others were found by employees of this board and were at once placed in working order. A number of other hydrants were found with some ice in them but not sufficient to prevent the pressure of the water from clearing them when the valve was opened.

Three hydrants have been broken during the year. One by the Michigan Central railroad company, one by the Flint & Pere Marquette railroad company and one by the city fire department while in use. Several others have required small repairs to keep them in good order and ready for immediate use at all times. All of the hydrants have been gone over carefully twice during the summer and fall and thoroughly oiled, blowed off and placed in as good condition as possible.

The entire cost of inspection and repairs on hydrants was $149.35. The entire amount paid out for repairs on main distribution was $752.78, which includes the purchase and repairs of tools, cleaning the wells at the pumping station and the several items above enumerated.

WATER METERS.

The number of meters put in during the year
and the number taken out 17, making whole nu
meters set and in use at the close of the year 327.

Elevator and motor indicators, 3. Ninety-three
and 3 indicators are classed as manufacturing, th
measured by them being used mainly for manufact
power purposes; 228 are classed as domestic an
test meters on pipes supplying several consum
placed with a view to determine the necessity for
meters to the separate services attached to these pipes.

Of the meters taken out, 7 were replaced by o
more satisfactory size or manufacture, 8 were rem
account of use of water from the services to which th
attached being permanently discontinued and 2 w
meters which it was no longer necessary to retain in u

One meter was found frozen, but was not serio
jured and after slight repairs was returned to service;
been found broken, usually in the registering gear,
and replaced and 35 unbroken meters have been fo
structed with pieces of wood or other substance
registering.

The total quantity of water supplied through met
122,808,109 gallons, an increase of about 16,000,000
over the year 1890.

The amount collected for metered water was $1
and the amount uncollected at the close of the year
making the total amount charged for water supplied
meters $10,625,10, an average of about 8⅔ cents pe
gallons. The quantity passed through manuf
meters was 82,268,172 gallons, for which the amount
was $6,596.18 or about 8 cents per 1,000 gallons.

The quantity supplied through domestic meters
539,937 gallons. Amount charged therefor, $4.
Nearly 10 cents per 1,000 gallons.

The meters set were of the following sizes and patterns:

	3-in.	2-in.	1½-in.	1-in.	¾-in.	⅝-in.	½-in.	Total.
Union Rotary	2	1				7		10
Union Duplex						2		2
Crown				1	1			2
Empire					1		1	2
Worthington			1					1
Hersey						2		2
Thomson				2		56		58
Total	2	1	1	3	2	67	1	77

Meters taken out:

	3-in.	2-in.	1½-in.	1-in.	¾-in.	⅝-in.	½-in.	Total.
Union Rotary	2		1	1				4
Crown				2	1		3	6
Empire					1			1
Worthington		1						1
Hersey						3		3
Thomson					1	1		2
Total	2	1	1	3	3	4	3	17

The amount paid on account of meters was:

For new meters (74)	$ 962 03
For pipe fittings and meter connections	14 08
For setting and boxing meters	108 26
	$ 1,084 37

The cost of keeping meters in repair including the monthly reading $312.94.

The meters now in service are:

	8-in.	4-in.	3-in.	2-in.	1½-in.	1-in.	¾-in.	⅝-in.	½-in.	⅜-in.	Total.
Un'n Rot'y	1	5	19	6	3	2	1	9			46
Un'n Dplx.								22			22
Crown					1	21	31		25	1	79
Empire						6	34		23		63
Wrthingt'n				4	6			10			20
Hersey						2	5	21			28
Thomson						2	1	66			69
Total	1	5	19	10	10	33	72	128	48	1	327

Motor indicator 1
Elevator indicators 2

SERVICES.

The number of new service connections made with the mai pipes during the year was 120, of which 119 were made wi corporation stops and 1 with cast iron branch.

The number of connections taken out was 12, leavin whole number of service connections in main pipes 1,740.

The connections put in were:

	4-in. branch	1-in.	¾-in.	⅝-in.	½-in.	Total
In cast iron main pipes		1	.....	.....	2	3
In Wyckoff main pipes	1	12	13	52	39	117
Total.....	1	13	13	52	41	120

The connections taken out were:

	2-in.	1-in.	¾-in.	⅝-in.	½-in.	Tota
From Wyckoff main pipe	2	3	2	1	4	1

TOTAL SERVICE CONNECTIONS IN MAIN PIPES DEC. 31, 189

	BRANCH CONNECTIONS.					CORPORATIONS.						
	8 in	6 in	4 in	3 in	2 in	2 in	1¼ in	1 in	¾ in	⅝ in	½ in	⅜ in
Cast Iron Main	.....	2	9	.....	.....	2	6	48	58	35	20	1
Wyckoff Main	1	3	14	1	1	9	.....	431	184	332	509	.....
	1	5	23	1	1	11	6	232	489	367	529	1

Of these connections 85 have been abandoned and m of these are closed at the main and the service pipe disconnec ed; 1,655 still have the service pipes connected.

Of the service connections put in during the year 17 we to replace connections taken out or abandoned and one w for additional supply to an old service.

The number of separate services supplied through the other 102 new connections is 108, and 11 new branch services were connected with services put in in former years. One service heretofore reported as abandoned was renewed and 5 services abandoned and not replaced. Whole number of separate service in use, 1,799; of which 1,385 are open and 414 closed at the curb.

The number of services opened during the year by employees of the board was 314; and the number shut off 296. Of the services shut off 72 were closed at the request of the consumer, 100 were premises found vacant, 29 for leaks and 95 for non-payment of rates.

The amount expended during the year on account of service connections was:

For corporations, stops bought	$	84 85
For branch connections and pipes		18 54
For labor and tools connecting taps		82 10
	$	185 49

The amount received for service connection and connecting large pipes was, $468.38.

The amount expended on account of repairs and care of services, including shutting off and turning in, inspection of premises, etc., was $361.65. Much trouble is experienced in keeping proper accounts with consumers and records of services and uses of water throughout the city, from a disregard of the plumbing rules of the department.

Some of the plumbing shops are very negligent about making returns, even of new work and much more so about extensions. Often applying to the office for their permits weeks after the work is completed, and often neglecting to apply for a permit at all. A considerable number of services closed for non-payment of rates or other violation of the rules are found open every year. In some cases these services are doubtless opened by the consumers themselves, they obtaining

a key from some plumbing shop on some pretext or othe
in most cases the consumer gets the water by applying
plumber for some slight repairs to a fixture. When th
pairs are completed the workman leaves the water on w
reporting the matter to the water office, and it is only
inspection of the premises that the matter is disco
These infractions of the rules are not so much the fault
licensed plumbers themselves as of the proprietors of the
where they are employed. Apprentices and unlicensed
men are frequently sent out to do small jobs not req
skilled labor. These persons are perhaps not familiar w
rules, or, if they are, care nothing about them, looking t
employer as being responsible and not themselves, and
likely to leave the water turned on to premises where the
it shut off as not, if the occupant of the premises request
has been the effort of the department to remedy these d
ties without proceeding to extreme measures, but if they
tinue, it will be necessary to enforce the ordinance by c
the arrest of any unlicensed person found doing work
character, and cancelling the license of any plumber
such work without a permit.

Respectfully Submitted,

E. L. DUNBAR,

Supt. and Sec

Bay City, Feb. 12, 1892.

MATERIAL CONSUMED IN RUNNING ENGINES.

2,942 cords wood	$	1,912 30
145 8-10 gallons cylinder oil		67 09
41 lbs. lubricant		6 15
1 gallon lard oil		30
Red lead and boiled oil		90
22½ lbs. cotton and hemp packing		5 10
21½ lbs. patent packing		19 52
60¼ lbs, square rubber packing		33 43
3¾ lbs. sheet rubber		95
4 lbs. boiler gaskets		2 30
12 lbs. valve leather		3 84
347 lbs. wiping rags		13 38
11½ lbs. Tripoli, rotten, stone and oxalicacid		1 57
10 lbs. soda		30
Concentrated lye		1 02
Emery and emery paper		81
Soap		2 58
Brooms		2 71
250 lbs.. tri sodium phosphates		40 00
587 gallons kerosene oil		41 88
25 lamp chimneys		1 25
Wicks and wicking and matches		1 16
Steam hose, tools, sheet brass, etc		25 38
Ice for season		12 65
	$	2,196 57

MATERIAL ON HAND DEC. 31, 1891, FOR RUNNING PUMPING ENGINES.

38 cords wood	$	24 70
10 gallons cylinder oil		4 50
5 lbs. lubricant		75
¼ gallon lard oil		15
1 lb cotton packing		30
1 lb hemp packing		20
5 lbs ⅝ square rubber packing		2 90
81 lbs 1-inch square rubber packing		46 98
3¼ lbs Fibrous piston packing		4 87
8 lbs Heston packing		12 00
3 lbs Goodsell packing		4 50
7½ lbs boiler gaskets		4 02
10½ lbs air pump valves		15 75
7¼ lbs sheet rubber		1 81
115 lbs wiping rags		4 60
1 lb tripoli		10
10 lbs rotten stone		75
5 boxes consentrated lye		63
58 bars soap		2 17
¼ lb emery		04
2 brooms		54
30 gallons kerosene oil		2 03
14 lamp chimneys		70
1 dozen lamp wicks		15
137 boxes matches		1 56
Steam hose, gas pipe, etc		31 80
30 lbs rivets		2 70
	$	171 20

Uses of water supplied at fixed or schedule rates:

1 Ashery.
4 Bakeries.
1 Bank.
9 Barber shops.
7 Bath rooms (public.)
1 Bath room (Turkish.)
240 Baths (private.)
6 Blacksmith shops.
11 Boilers (for power.)
8 Bottling works.
5 Boarding houses.
20 Business Blocks (not classified).
1 Business college.
10 Butcher shops.
1 Canning works.
2 Carriage shops.
1 Cemetery.
1 Chapel.
2 Churches.
2 Cigar factories.
2 Clothes cleaning.
1 carpet cleaning.
693 Dwellings.
1 Express office.
101 Families in blocks.
3 Fire pipes.
4 Fountains.
1 Foundry.
1 Gas works.
3 Gas engines.
1 Gun shop.
7 Halls (public).
3 Harness shops.
392 Hose for sprinkling.
28 Hotels.
1 Laboratory.
3 Laundries.
3 Machine shops.
23 Offices.
1 Paint shop.
1 Pawn shop.
1 Passenger depot.
3 Photograph galleries.
3 Plumber shops.
1 Post office.
1 Printing office.
1 Pasture.
2 Refrigerators.
8 Restaurants.
57 Saloons.
1 Salt crusher.
14 School buildings.
7 Stables (livery.)
7 Stables (mill.)
135 Stables (private.)
1 Stable (sale.)
1 Suspender factory.
1 Stone yard.
92 Stores.
1 Soap factory.
1 Tailor shop.
2 Telegraph offices.
1 Undertaker.
743 Water closets and urinals.
60 Water closets in schools.
10 Water motors.
1 Wood yard.
2 Warehouses.

Uses supplied through meters:

2 Bakeries.
125 Baths (private.)
2 Bath rooms (public.)
3 Bottling works.
16 Business blocks (not classified.)
36 Boilers (for power.)
7 Box factories.
1 Brewery.
2 Boarding houses.
3 Barber shops.
2 Boiler shops.
3 Banks.
2 Butcher shops.
1 Business college.
1 Club room.
1 Court house.
1 County jail.
4 Churches.
1 Cooper shop.
3 Halls.
1 Locomotive stand pipe.
2 Laundries.
6 Machine shops.
22 Offices.
1 Opera house.
7 Planing mills.
2 Passenger depots.
1 Pipe works.
1 Printing office.
1 Plow works.
1 Plumber shop.
1 Photograph gallery.
1 Reel factory.
1 Round house.
3 Restaurants.
6 Saloons.
5 Stables (livery.)
2 Stables)street car.)

1 Coal and wood yard.
1 Chemical works.
1 Cracker factory.
1 Cross arm factory.
2 Cemeteries.
191 Dwellings.
6 Drill houses.
1 Electric light station.
3 Elevators.
3 Flouring mills.
5 Founderies.
1 Government building.
1 Gas engine.
2 Green houses.
134 Hose for sprinkling.
16 Hotels.
8 Stables (mill.)
45 Stables (private.)
2 Stables (hotel.)
1 Stable ('bus and hack.)
1 Soap factory.
22 Stores.
14 Saw mills.
13 Salt blocks.
1 School building.
1 Sash, blind and door factory.
32 Water meters.
2 Ware houses.
1 Woodenware works.
475 Water closets.
25 Pipes for fire protection.

Uses and premises shut off:

1 Bank.
15 Baths (private.)
3 Blacksmith shops.
4 Boarding house.
1 Boat dock.
1 Box factory.
2 Butcher shops.
3 Barber shops.
5 Business blocks (not classified.)
1 Broom factory.
2 Churches.
170 Dwellings.
2 Drill houses.
1 Elevator.
1 Foundry.
65 Hose for sprinkling.
9 Hotels.
4 Hydrants (fire protection.)
1 Machine shop.
1 Market garden.
5 Offices.
1 Pasture.
1 Paint shop.
2 Restaurants.
1 Rink.
11 Saloons.
1 Saw mill.
3 Salt blocks.
1 Shingle mill.
19 Stables.
1 Slaughter house.
43 Stores.
1 Stable (livery.)
1 Tool house.
5 Vacant shops or factories.
54 Vacant lots.
44 Water closets.

City uses for which no rates are charged:

1 City building occupied by police station and city offices.
1 City building occupied by public library and city offices.
5 Steamer, hose and truck houses, 19 horses and 2 steam fire engines.
15 Water closets in city buildings.
1 Electric light station (2 boilers.)
9 Public watering troughs.
3 Ornamental fountains in public squares.
10 Hose for sprinkling parks.
308 Public fire hndrants.

SUMMARY OF STATISTICS.

REPORT OF 1891.

Water Works of Bay City, Bay County, Michigan.
Built in 1872.
Owned by the City.
Source of supply, Saginaw Bay, an arm of Lake H
Mode of supply, direct pumping.

PUMPING.

1. Builders of pumping machinery, Holly Manufacturing Co
2. Kind of fuel, pine slabs and edgings.
3. Fuel consumed, 2,942 cords---cost $1,912.30. Equal to 1,61
soft coal.
6. Total water pumped in gallons, 1,014,475,024.
8. Average dynamic head, 125 feet.
9. Gallons pumped per pound of coal, 627.
10. Duty = $\frac{1{,}014{,}475{,}024 \times 8.34 \times 100 \times 125}{1{,}618{,}100}$ = 65,360,000.

Cost of pumping based on pumping station expenses, $6,432.08
11. Per million gallons pumped, $6.34.
12. Per million gallons raised one foot, $0.051.

Cost of pumping based on total maintenance including interes
city, $41,727.15.
13. Per million gallons pumped, $41.13.
14. Per million gallons raised 1 foot, $0.34.

CONSUMPTION.

1. Estimated population to date, 32,000.
2. Estimated population on pipe lines, 18,500.
3. Estimated population supplied, 13,000.
4. Total gallons supplied, 1,014,475,024.
5. Passed through domestic meters, 40,539,937 4 per cent.
6. Passed through manufacturing meters, 82,268,172, 8 1-10 p
7. Average daily consumption, 2,779,384 gallons.
8. Gallons per day to each inhabitant, 87.
9. Gallons per day to each consumer, 214.
10. Gallons per day to each service (distribution 22), 1,679.

Distribution.

1. Material, cast iron and Wyckoff patent pipe.
2. Size, 3 inch to 20 inch.
3. Extended, 18,105.
4. Abandoned, 49 feet.
5. Total in use, 38 miles.
6. Cost of repairs, $20.00 per mile.
7. Leaks per mile, 1½.
8. Small distribution less than 4 inch, 319 feet.
9. Hydrants added, 19.
10. Number hydrants in use, 308.
11. Stop gates added, 56.
12. Number in use, 565.
13. Number small gates, less than 4 inch, 5.
14. Number of blow-off gates, 21.
15. Range of pressure at center day and night, 28 to 42 pounds.

Services.

16. Material, lead, wrought iron and Wyckoff patent.
17. Sizes, ¾ inch to 8 inch.
18. Service taps added, 108.
19. Number in use, 1,655.
25. Meters added, 60.
26. Number in use, 327. Domestic, 228; Manufacturing, 93. Test, 6.
27. Motors and elevators added, 13.
28. Number in use, 45.

FINANCIAL--MAINTENANCE.

RECEIPTS—DIVISION I.

A.	Water rates, domestic	$17,589 25	
B.	Water rates, manufacturing	6,923 24	
C.	Net receipts from water		$24,512 46
D.	Miscellaneous service connections, rents, etc		837 27
	E.—Total		$25,349 76
	From public funds—		
J.	Tax levy for interest		28,835 00
			$54,184 76

DIVISION II.

	From fixed rates—		
L.	Domestic	$13,491 14	
M.	Manufacturing	388 00	
	N.—Total		$13,879 14
	From meter rates—		
O.	Domestic	4,098 11	
P.	Manufacturing	6,535 24	
	Q.—Total		10,633 35

EXPENDITURES.

A. A.	Management and repairs	$12,062 31	
B. B.	Interest paid by iax levy	28,835 00	
	Interest paid by water works	829 84	
C. C.	Total maintenance for year		$41,727 15
	Bills Payable		4,500 00
D. D.	Balance to construction		7,957 61
			$54,184 76

CONSTRUCTION.

R.	Balance from previous years	$ 6,301 39	
	Balance from Maintenance	7,957 61	
	Bonds sold	75,000 00	

F. F.	Extension of Mains	$42,136 82	
H. H.	Water Meters	1,084 37	
I. I.	Total for construction		$43,221 19
	Bills payable		11,629 73
	Temporary loan		10,000 00
	Balance		24,408 08

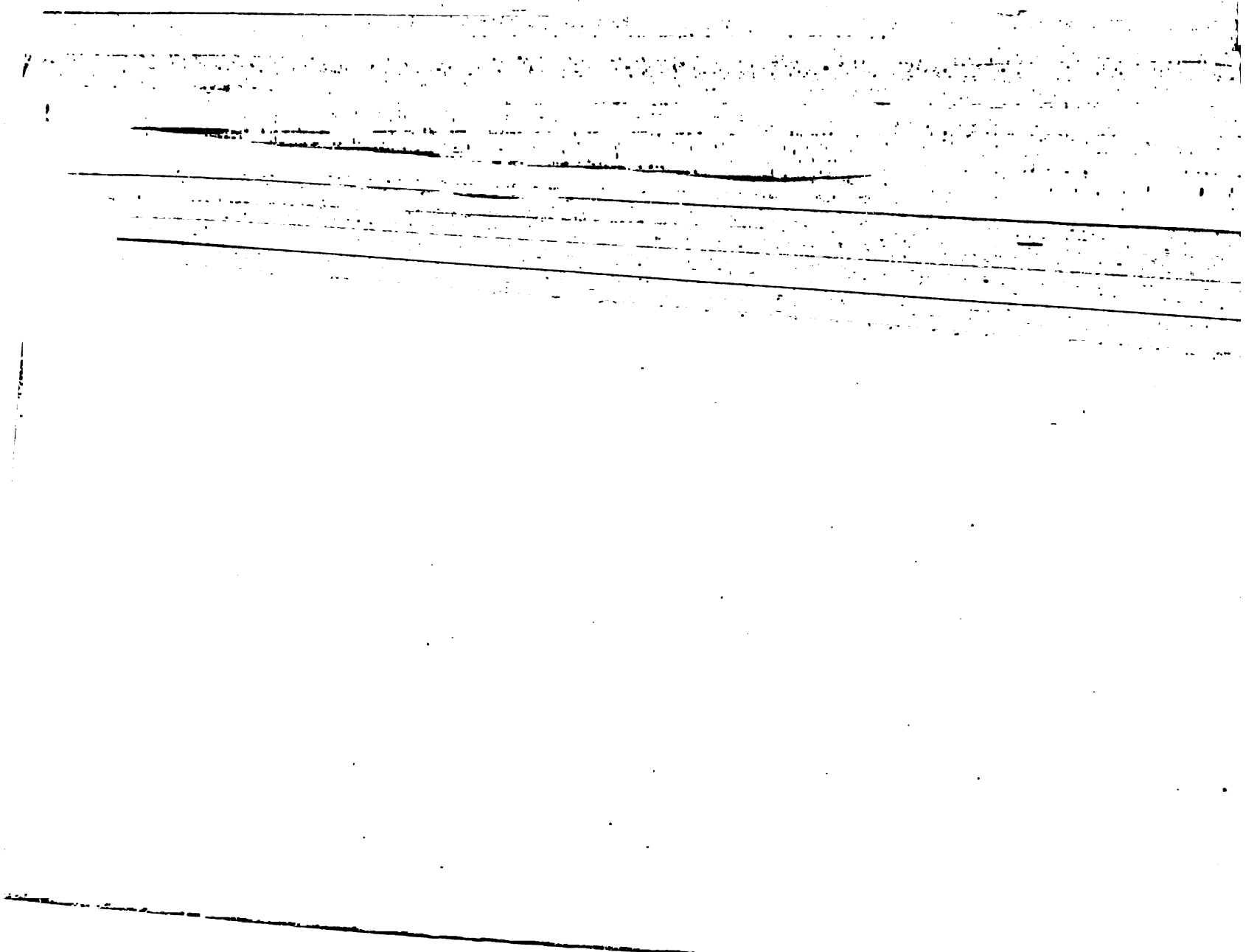
Twenty-first Annual Report

—OF THE—

Superintendent of Water Works.

BAY CITY, MICHIGAN.

1892



Twenty-first Annual Report

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BAY CITY, MICHIGAN.

1892

J. A. HOPKINS,
PRINTER,
TIMES JOB ROOMS
BAY CITY.

COMPLIMENTS OF

E. L. DUNBAR,

SUPERINTENDENT.

BAY CITY, MICHIGAN.

Water Department.

December 31st, 1892.

COMMISSIONERS.

ANDREW WALTON, President.
(Term expires Sept. 6th, 1894)

G. HENRY SHEARER.
(Term expires Sept. 6th, 1895)

BENJAMIN F. RAY.
(Term expires Sept. 6th, 1896)

SANFORD V. WILKIN.
(Term expires Sept. 6th, 1897)

LOUIS MORITZ.
(Term expires Sept. 6th, 1898)

DUNCAN McGREGOR.
(Term expires Sept. 6th, 1899)

FREMONT J. TROMBLE.
(Term expires Sept. 6th, 1893)

OFFICERS.

President, ... ANDREW WALTON.
Secretary and Superintendent, . . E. L. DUNBAR.

Office Assistant, ... T. A. Delzell.
Inspector, ... Frank H. Collins.
Reservoir Keeper, ... Levi D. Carpenter.
First Engineer, ... A. B. Verity.
Second Engineer, ... James E. Darling.
Fireman, ... James H. McGibbons.
Fireman, ... Patrick O'Hare.

SUPERINTENDENT'S REPORT.

To the Honorable Board of Commissioners of Water Works of Bay City, Michigan:

Gentlemen—I respectfully submit the following report for the year ending December 31st, 1892.

The term of office of Commissioner Duncan McGregor expired Sept. 6th, 1892. At a regular session of the Common Council, held August 29th, 1892, Mr. McGregor was re-appointed a member of the Board, his present term of office being for seven years from the 6th day of September, 1892.

The most important work of the department during the year has been the completion of the 20-inch and 16-inch main from the pumping station to the southern portion of the city. At the close of the year 1891 this pipe had been laid from the pumping station to Second street, and the material was on the ground for its completion to Twenty-third street. Neither the size or location of this pipe south of Twenty-third street had at that time been determined.

At a session of the Board held March 8th, 1892, it was decided to continue the pipe, 16 inches in diameter, to the corner of South Centre and Harrison streets, and, by mutual agreement, the contract entered into with the Addyston Pipe and Steel Company in 1891 for furnishing the pipe to Twenty-third street was extended to cover the balance of the pipe and special castings required. The delivery of this pipe commenced in June and was completed about the middle of July.

The work of laying this main was resumed early in April, at the point in Washington avenue at Second street where it was suspended in 1891, and very satisfactory progress was made until Twenty-third street was reached, the work being completed to the corner of Twenty-third street and Bowery early in June. A delay of about two weeks was here experienced in letting contract for the balance of trenching, and work was not resumed until near the last of June. On account of the almost continuous beds of

quicksand encountered after nearing Water street, on Twenty-third s
the rate of progress was slow and the main line was not completed to S
Center street until the middle of September, and it was nearly the m
of October before the hydrants were set and all connections made
intersecting mains. Since October 13th this pipe has been in contin
service, and the character of the work is very well demonstrated by
fact that there has not been any indication of a leak in the entire le
of the line from the pumping station to South Center street, a distan
more than four miles. The trenching and backfilling were let by cont
but the pipe laying and jointing were done by day labor.

The entire cost of this main pipe was $54,190.56, which include
new fire hydrants, with their pipe connections, and transferring eight
hydrants from their connection with the old main to the new; also
cost of connecting all intersecting mains and five branch services for
protection transferred from the old main. This statement of cost does
include about $600 value of material purchased but not used.

The entire cost of the improvement to the supply to the southern
tion of the city inaugurated in 1890, and to meet the cost of which $7
in bonds were issued by the city in 1891, was $78,369.85, which includes
cost of the 10-inch main pipe laid in 1890 from Tenth street to South
ter street and the interest paid on the time orders issued to the Mich
Pipe Company on account of material furnished for that line. The ex
over $75,000 was paid from the current receipts of this department.

The fire which devastated a large portion of the Sixth ward on the
of July was the most disastrous that has ever visited our city; and w
the writer cannot speak from personal observation, he having been ne
sarily absent from the city at the time, from the best information he co
obtain immediately upon his return, two days after the fire, it appears t
no blame could be placed upon this department, for the fire passing beyo
the control of the fire department, the spread of the fire was so ra
and the heat so intense that the firemen were driven from the hose, a
could not reach their hydrants to close them after they found they m
abandon them. Several of the first hydrants coupled to were abandon
in this way, and there seem to have been five hydrants running at one ti
with open butts, all of which remained open from two to three hours,
until the fire in their immediate vicinity had burned itself out and t
embers cooled sufficiently to permit the firemen to reach them. Duri
the time these hydrants were open it was of course impossible for the wa

works to supply effective fire streams from other hydrants located on the same main lines of pipe, or from other lines in the immediate vicinity which were connected with these mains near the point where these open hydrants were located; but, as nearly all the hose of our city fire department had been destroyed early in the fire, at the same time the hydrants were abandoned, no substantial effort could be made to stay the conflagration until a new supply of hose was obtained through the kindness of neighboring cities. When this hose arrived on the ground the fire department, aided by the fire departments of our neighbors, succeeded, by the most determined effort, in checking the spread of the flames on the southeast and northeast, saving the Sixth ward school, the large plant of the Michigan Box Company (one building of which was consumed), and a large number of dwellings east of Broadway, south of Thirty-third street, which would certainly have been destroyed but for the number of streams which they were enabled to bring into service from the water works hydrants. The pumping machinery supplied the demands made upon it that day in a very satisfactory manner. The maximum estimated capacity of all of the engines is ten and a half millions of gallons in 24 hours, but this rate of pumpage was exceeded for more than two hours, while the fire hydrants were open as mentioned above, and this by the Gaskill and Quadruplex engines alone, the Rotaries not being brought into service on account of the lack of boiler capacity to furnish steam for running the high pressure engine driving these pumps. Had there been another boiler to place in service the work could have been done with ease by both boilers and engines; as it was, the three boilers were forced to their utmost capacity and the Gaskill and Quadruplex engines were run at a dangerously high speed, but fortunately without accident or breakage of any kind. The reason for not starting the otner engine was that it requires a much larger quantity of steam to do the same work with the high pressure engine than it does with either the Gaskill or Quadruplex.

There was a report iu circulation soon after the fire that the supply of water to the pumps was insufficient, and that if more could have been brought up into the wells more couid have been supplied at the fire. A resolution was adopted by the Common Council, instructing the Board to increase the supply from the river. Mr. Verity informs me that at no time was the pressure lowered or the speed of the engines lessened on account of lack of water in the wells, but that during the entire time of the heaviest demand upon the works the engines were run as fast as the boilers

would generate steam to run them, and that there was a safe marg supply over the bottom of the suction pipes; but in order to comply the instructions of the Common Council an additional opening has made in the front of the inlet crib at the river, materially increasin quantity of water which may be brought in from that source in ca necessity.

A considerable percentage of the extreme demand upon the works during this fire, and undoubtedly the cause of a material r tion of the pressure where it was most needed, was the reckless disr of the rights and perils of those in immediate danger by person removed from the scene of the conflagration who attached hose to supply pipes from the water works, and some of them even to th hydrants in the streets, for the purpose of wetting down their premis some cases as many as four large fire streams being taken for this pu by a single establishment. There is creditable authority for the state that water was taken for this purpose from the water works on pre where there was ample pumping capacity of their own, with suction from the river, and which would have furnished an ample supply fo purpose as long as no fire started on the premises.

The quantity of water pumped during the year was about fift and a half million gallons less than for the year 1891, and the receip the department were $383.93 less than for that year, the receipts water rates being $272.38 less. Several causes led to this result, prin of which were:—

1st. Cutting off the supply to the Phoenix block elevator, which done at the request of the Board, on account of the manner in whic supply was taken. This reduced the consumption over twenty millio gallons and the revenue nearly $1,000.

2nd. The fire of July 25th cut off over 30 consumers, reduced the sumption several millions of gallons and the revenue about $300.

3rd. The largely increased rainfall as compared with that of se preceding years materially reduced the quantity of water used for s kling lawns.

The increase in revenue from new consumers was about the sam for some years past, or nearly $1,000.

FINANCIAL.

RECEIPTS.

The receipts of the department during the year were $24,965 63, from the following sources:

Water rates, roll of 1887	$ 6 00	
Water rates, roll of 1888	5 67	
Water rates, roll of 1890	12 08	
Water rates, roll of 1891	188 74	
Water rates, roll of 1892	24,027 62	
Total from water rates		$ 24,240 11
Plumbers' license	$ 35 00	
Rent of boom	200 00	
Service connections	281 00	
Iron pipe sold (not used on works)	104 53	
Iron pipe used on branch services	33 45	
Valves	12 50	
Fire hydrants	32 00	
Labor putting in branch services	27 04	
Total miscellaneous		725 72
		$ 24,965 63

This amount has been deposited with the City Treasurer, as per receipts on file as follows:

January 30th, 1892	$ 1,351 70	
February 29th, "	1,002 18	
March 31st, "	1,315 90	
April 30th, "	2,045 57	
May 31st, "	1,127 07	
June 30th, "	*1,274 87	
July 30th, "	2,785 40	
August 31st, "	1,230 78	
September 30th, "	1,652 80	
October 31st, "	2,497 60	
November 30th, "	*2,538 74	
December 31st, "	6,142 93	
		$ 24,965 63

*Does not include $2.92 water rates returned to consumers in June and $3.23 water rates returned to consumers in November.

The total amount of water rates charged on the roll of 18
$24,467.10, which is $442.82 less than amount charged on roll of 189

The amounts charged on roll of 1892 were:

For water supplied at fixed rates	$13,897 28
For water supplied at meter rates	10,425 22
For water supplied for building purposes	144 60
	$24,467 10

The amounts collected on roll of 1892 were:

From fixed rates	$13,709 34
From meter rates	10,250 13
From building purposes	108 15
	$24,027 62

The amounts uncollected are:

From fixed rates	$ 227 94
From meter rates	175 19
From building purposes	36 35
	$ 439 48

The amounts collected on rolls of 1881, 1888, 1890 and 1891 were

From fixed rates	$ 133 89
From meter rates	76 74
From building purposes	1 86
	$ 212 49

The total amount of water rates collected and uncollected o
year's roll since the works commenced supplying water has b
follows:

ROLL.	COLLECTED.	UNCOLLECTED	TOT'L
1873 January 1st to April 30th	$ 728 82		$
1873-4—May 1st, 1873, to April 30th, 1874	5,440 80	$ 1 60	
1874-5—May 1st, 1874, to April 30th, 1875	6,908 16	44 85	
1875—May 1st to December 31st, 1875	7,399 55	28 46	
1876	9,571 26	82 73	
1877	9,604 26	134 19	
1878	10,078 15	324 71	1
1879	11,708 97	136 07	1
1880	13,155 74	120 25	1
1881	15,002 61	212 40	1
1882	17,352 47	158 85	1
1883	18,713 46	98 64	1
1884	18,892 02	132 64	1
1885	19,716 73	270 58	1
1886	19,348 61	126 74	1
1887	19,435 25	88 00	1
1888	21,266 45	132 97	2
1889	22,118 45	115 05	2
1890	23,279 74	220 88	2
1891	24,578 76	331 16	2
1892	24,027 62	439 48	2
TOTALS	$318,197 88	$ 3,201 25	$32

EXPENDITURES.

The expenditures of the department for the year have been $37,965.45, for the following accounts:

For maintenance accounts:

OFFICE DEPARTMENT:		
Salaries	$ 2,600 00	
Expenses	483 13	
STREET AND SERVICE DEPARTMENT:		
Repairs on main distribution	850 27	
Repairs on services and turning on and off	382 21	
Repairs and care of meters	387 38	
Repairs and care of inlet works	423 25	
Service connections	245 56	
PUMPING DEPARTMEMT:		
Salaries	3,594 32	
Fuel	1,854 99	
Oil, packing and supplies	262 43	
Repairs on engines and boilers	138 20	
Repairs on boiler arches	68 66	
REPAIRS TO BUILDINGS, ETC.:		
Repairs on engine house	12 46	
Total for maintenance		$ 11,302 86

For construction accounts:

WATER METER ACCOUNT:		
Meters and Fittings	$ 1,051 64	
Setting meters	145 51	
MAIN DISTRIBUTION:		
Cast iron pipe and specials	10,942 86	
Wyckoff patent pipe	397 18	
Valves	1,078 05	
Fire hydrants	1,672 95	
Laying cast iron pipe	6,612 17	
Laying Wyckoff pipe	82 28	
Total for construction		$ 21,982 50
BILLS PAYABLE AND INTEREST:		
Special Order No. 4 to Holly Manuf'g Co	$ 4,500 00	
Interest on Special Order No. 4	180 00	
Total bills payable and interest		4,680 00
		$ 37,965 45

The payment of Special Order No. 4 retired the last of the orders issued to The Holly Manufacturing Company in 1886, for the Gaskill

pumping engines. There is now no outstanding indebtedness excep
bonded debt.

WATER WORKS FUND AND CITY TREASURER.

CITY WATER WORKS FUND:	DR.	C
To balance in fund January 1st, 1892	$ 24,408 08	
" Collections deposited by Secretary	24,965 63	
By amounts withdrawn on Recorder's warrants—		
January 30th, 1892—Warrant No. 276, Statement 61		
February 29th, " " " 277 " 62		
March 31st, " " " 278 " 63		1
April 30th, " " " 279 " 64		4
May 31st, " " " 280 " 65		1
June 30th, " " " 281 " 66		8
July 30th, " " " 282 " 67		10
August 31st, " " " 283 " 68		2
September 30th, " " " 284 " 69		4
October 31st, " " " 285 " 70		1
November 30th, " " " 285½ " 71		5
December 31st, " " " 286 " 72		
Balance		11
	$ 49,373 71	$ 49

CITY TREASURER, AS TREAS. OF BOARD OF WATER WORKS:	DR.	C
To Recorder's warrants on City Water Works Fund, No's 276 to 286, inclusive	$ 37,965 45	
By paid orders of Secretary, No's 1,401 to 1,814, inclusive		37
	$ 37,965 45	$ 37

LEDGER BALANCES.

Balances of accounts for 1892:

LEDGER D.	DR.	C
Folio 327, City water works fund		$ 12
" 338, Water rates roll of 1881		
" 337, " " " 1888		
" 337, " " " 1890		
" 336, " " " 1891		
" 335, " " " 1892		24
" 340, Plumbers' licenses		
" 340, Rents, dockage, etc.		
" 348, Service connections		

LEDGER D (Coutinued)	DR.	CR.
Folio 341, Bills payable	$ 4,500 00	
" 341, Interest	180 00	
" 342, Office department, salaries	2,600 00	
" 347, " " expenses	488 13	
" 349, Street and service dep't, repairs on main distribution	850 27	
" 345, " " " " repairs on services and shut-offs	382 21	
" 346, " " " " repairs and care of meters	387 38	
" 347, " " " " repairs and care of inlet works	423 25	
" 349, Repairs to engine house	12 46	
" 350, Pumping department, salaries	3,594 32	
" 351, " " fuel	1,854 99	
" 352, " " oil, packing and supplies	262 43	
" 353, " " repairs to engines and boilers	138 20	
" 354, " " repairs to boiler arches	68 66	
" 354, Water meters	1,197 15	
" 356, Main distribution, cast iron pipe	10,804 88	
" 357, " " Wyckoff pipe	397 18	
" 358, " " valves	1,065 55	
" 359, " " fire hydrants	1,640 95	
" 362, " " laying iron pipe	6,585 13	
" 361, " " laying Wyckoff pipe	82 23	
	$ 37,510 37	$ 37,510 37

Ledger balances from January 1st, 1872, to December 31st, 1892:

LEDGER D.	DR.	CR.
Folio 430, Bay City bond account		$ 443,045 87
" 430, Water assessment, frontage tax		736 07
" 432, Water rates, Rolls of 1872 to 1882		106,820 79
" 432, " " Roll of 1883		18,713 46
" 433, " " " 1884		18,892 02
" 433, " " " 1885		19,716 73
" 434, " " " 1886		19,348 61
" 434, " " " 1887		19,435 25
" 435, " " " 1888		21,266 45
" 435, " " " 1889		22,118 45
" 436, " " " 1890		23,279 74
" 436, " " " 1891		24,578 76
" 437, " " " 1892		24,027 62
" 438, Plumbers' license		647 70
" 438, Rents, dockage, etc		2,387 93
" 439, Service taps and service boxes		2,761 43
" 439, Water works fund	$ 11,408 26	
" 440, Real estate	6,724 83	
" 440, Dock tramways and store shed	1,882 63	
" 441, Engine house, chimney and wells	19,097 42	
" 441, Engine foundations, boiler foundations and arches	5,881 87	
" 442, Pumping machinery	57,673 05	
" 442, Inlet from Saginaw river	3,218 99	
" 443, Inlet from Saginaw Bay	84,778 37	
" 443, Reservoir, breakwater, etc, at bay	24,713 78	
" 444, Iron pipe and branch castings	100,585 95	
" 444, Wyckoff patent pipe	124,063 32	
" 445, Valves for street mains	15,179 16	

LEDGER D (Continued).		DR.
"	445, Fire hydrants	14,079 54
"	446, Laying pipe	55,174 56
"	446, Building at bay	452 46
"	447, Water meter	14,213 91
"	447, Furniture and fixtures	900 96
"	448, Implements, (construction)	1,713 61
"	448, Engineering and general superintendance "	7,856 17
"	449, Traveling expenses, "	306 29
"	449, Insurance expenses, "	29 00
"	450, Interest, discounts and commissions, "	4,224 17
"	451, Office expenses and salaries	45,187 24
"	451, Repairs and care of hydrants, valves and pipes	13,431 75
"	452, Repairs and care of water meters	2,156 08
"	452, Repairs and care of inlet works	10,188 68
"	453, Repairs to engine house	1,265 39
"	453, Repairs to dock	13 28
"	454, Engineers' and firemen's wages	70,265 16
"	454, Fuel	51,385 62
"	455, Oil, packing and engineers' supplies	7,757 64
"	455, Repairs to pumping machinery	5,912 57
"	456, Repairs to engine foundations	51 46
"	456, Repairs to boiler arches	1,073 81
"	457, Implements and tools (repairs)	1,129 37
"	457, Interest on bills payable (time orders)	3,709 84
		$367,776 28

Net cost of construction to date $542,840.03.

The City Treasurer has paid during the year 1892, from moni
by tax levy (city bond and interest fund), the annual interest on o
ing water works bonds amounting to $29,170 (less coupons not pre
and has also retired $10,000 of the original issue, being series No.
January 15th, 1872, payable October 15th, 1892.



The total amount of water works bonds paid to date is $60,000, and the amount outstanding is $392,000.

WATER WORKS BONDS OUTSTANDING.

SERIES.	DATE OF ISSUE.	PAYABLE.	AMOUNT.	INTEREST.
No. 7	January 15, 1873	October 15, 1893	$10,000 00	8 per cent.
" 8	" " "	" " 1894	10,000 00	"
" 9	" " "	" " 1895	10,000 00	"
" 10	" " "	" " 1896	10,000 00	"
" 11	" " "	" " 1897	10,000 00	"
" 12	" " "	" " 1898	8,000 00	"
" 13	August 15, "	February 16, 1899	10,000 00	"
" 14	" " "	" " 1900	10,000 00	"
" 15	" " "	" " 1901	10,000 00	"
" 16	" " "	" " 1902	10,000 00	"
" 17	" " "	" " 1903	10,000 00	"
" 18	" " "	" " 1904	9,000 00	"
" 19	" " 1873	" " 1905	10,000 00	"
" 20	" " "	" " 1906	10,000 00	"
" 21	" " "	" " 1907	10,000 00	"
" 22	" " "	" " 1908	10,000 00	"
" 23	" " "	" " 1909	10,000 00	"
" 24	February " 1874	" " 1910	10,000 00	"
" 25	April " "	April 15, 1911	10,000 00	"
" 26	" " "	" " 1912	10,000 00	"
" 27	" " "	" " 1913	20,000 00	"
" 28	October " "	October 15, 1894	10,000 00	"
" 29	" " "	" " 1895	10,000 00	"
" 30	" " "	" " 1896	10,000 00	"
" 31	" " "	" " 1897	10,000 00	"
" 32	" " "	" " 1898	10,000 00	"
" 33	March 1, 1875	March 1, 1900	10,000 00	"
" 34	" " "	" " 1901	10,000 00	"
" 35	June " "	June " 1902	10 000 00	"
" 36	" " "	" " 1903	10,000 00	"
" 37	" " "	" " 1904	10 000 00	"
NOT SERIED				
No's 1 to 25	May 1st, 1891	May 1st, 1906	25,000 00	5 per cent.
" 26 to 50	" " "	" " 1911	25,000 00	"
" 51 to 63	" " "	" " 1917	12,500 00	"
" 64 to 76	" " "	" " 1918	12,500 00	"
			$392,000 00	

SOURCE OF SUPPLY.

The slightly higher level of the water in the lake, and the r
quantity of water pumped, have materially reduced the quantity o
which it was necessary to take from the river, the entire time th
valve has been open during the year being but five days, eight hou
nineteen minutes, of which three days and six hours were for sup
the ordinary demands, the water in the bay being at so low a sta
the head was not sufficient to deliver enough water to the pumping
for ordinary uses. The balance of the time was for supplying th
demand for fire service.

The frequent rains during the summer caused an increased di
from the river into the bay, and the prevailing westerly winds c
this discharge to the vicinity of the inlet has rendered the city
somewhat turbid during a large part of the summer. The clear
waters of the bay have been seen in the reservoir but a small portio
time until the bay was covered with ice and the effect of the win
the currents thereby neutralized.

The attention of the Board is again called to the fact that a m
isfactory supply can be obtained from the west side of the bay, and
be hoped that the construction of a new inlet from that source will
much longer delayed. No very expensive improvements to the
inlet works are recommended, but some repairs will be necessary
the coming season. The masonry at the end of the pipe should be
and all of the timber work at the influent and effluent chambers
reservoir either renewed or replaced with earthwork and masonry
reservoir should be cleaned and deepened, and the bottom covere
cement to prevent the vegetable growth which it has become diffi
control.

The total amount paid out during the year for the repair and
inlet works was $423 25.

Salary of Reservoir Keeper,	$ 420 00
Making opening in river inlet	3 25
	$ 423 25

PUMPING STATION.

The extraordinary demand upon the works during the fire of July 25th, proved the pumping engines to be in good conditi n, and the strain to which they were at that time subjected has not since developed any weak points, but that trial emphasized the demand heretofore made for more boiler capacity. An addition to the boiler room should be erected and two more boilers placed in service as soon as practicable. The boilers now in use are in good condition, considering the time they have been in service, but the inspector in his last report states that there is an increased accumulation of scale in two of them.

The total cost of repairs on engines, boilers and boiler arches for the year was $206.86.

Repairs on Gaskill engines	$ 46 65
Repairs on boilers, including grate bars	80 54
Repairs on feed pipes	11 01
Repairs on arches	68 66
	$206 86

The contract with Dolsen, Chapin & Co. for supplying fuel for operating the works, which contract has been in force several years, was continued at the same price as the previ us year, 35 cents per cord for mixed slabs and edgings piled on water works yard. At the commencement of the year 1892 there were 675 cords of thisfuelon the yard; as this was not sufficient to operate the works until the cut of 1892 was dry enough to burn, 152 cords of wood were purchased from Dolsen, Chapin & Co.'s yard, and two car loads, 47 700-2,000 tons, of Sebewaing coal were put in on trial. This coal was satisfactory, there being no trouble in making steam with it, but it cannot yet be delivered at a price to compete with the saw mill refuse, as we have been able heretofore to secure it.

The quantity of wood delivered on the yard by Dolsen, Chapin & Co, under the renewed agreement, wa2,766 cords,of which 1833 cords have been delivered in the fire room, leaving on the yard at the close of the year,

933 cords. Total number of cords delivered in the fire room dur
year, 2,660.

Total amount paid for fuel:

Wood	$1,7
Coal	1
	$1,8

The total amount paid for operating the pumping engines wa

For engineers' and firemen's services	$3,594 32
For fuel	1,854 99
For oil, packing and supplies	262 43
For repairs on engines and boilers	138 20
For repairs on boiler arches	68 66
	$5,918 60

The net cost of operating the pumping engines was:

For wages	$3,594 32
For fuel consumed	1,875 79
For oil, packing and supplies used	247 18
For repairs	206 86
	$5,924 15

The total number of gallons of water pumped was 962,95
which 943,947,192 gallons were pumped against a domestic pressu
pounds per square inch, at the pressure gauge, which is equivale
lift of 112 feet from the surface of the water in the wells, and 1
gallons were pumped against an average fire pressure of 73 65-100
at the gauge, equivalent to a lift of 190 feet from the water level i
Average lift of all water pumped, 113½ feet.

The cost figured on total engine house expenses was:

Per million gallons pumped	$ 6 15
Per million gallons raised 100 feet	5 42

The cost of fuel:

Per million gallons pumped	$ 1 95
Per million gallons raised 100 feet	1 71

Duty based on one cord of fuel being equal to 550 pounds of c
about 58,000,000.

The Gaskill engines were run 8,734 45-60 hours, pumping 951,444 000 gallons, and the Quadruplex engines were run 60¼ hours, pumping 8,509,655 gallons. No portion of the city supply was pumped by the high pressure engine and rotary pumps, but they have been started occasionally to see that they were in condition for use if required.

The longest continuous run of the Gaskill engines since they were started in 1886, was made from November 23rd, 1891, to March 10th, 1892, 107 days, during which time they pumped the entire supply to the city without being shut down.

Total quantity of water pumped each year since the works commenced operations, has been as follows:

	GALLONS.		GALLONS.
1873	142,477,725	1883	773,942,702
1874	294,714,798	1884	831 8.7,463
1875	416,756,579	1885	836.970,046
1876	518,197,129	1886	779,761,852
1877	538,847.186	1887	827,195,009
1878	530,197,397	1888	872,990,164
1879	672,344,128	1889	944 472,747
1880	827.067,372	1890	988,771.453
1881	944,382,043	1891	1,014,475,024
*1882	775,642,466	1892	962,953.662

*Commenced setting meters on large services.

The greatest quantity of water pumped in one day was 5,667,182 gallons on the 25th of July, of this amount 3,785,197 gallons were pumped in 10 hours.

The least quantity pumped in one day was 2,110,603 gallons, on the 1st day of January 1892.



WATER PUMPED. 1892.

MONTH.	GASKILL ENGINES.			QUADRUPLEX ENGIN'S			TOTALS.		FIRES.					
	Hours Run.	Revolutions.	Gallons Pumped	Hours Run.	Revolutions.	Gallons Pumped	Gallons Pumped	Daily Average	Number Alarms.	Hours Run.	Highest Pressure	Lowest Pressure	Average Pressure	Gallons Pumped
January.....	741	627,864	75,971,544				75,971,544	2,450,695	7	2.15	80	80	80	348,117
February.....	696	606,565	73,394,365				73,394.365	2,530,840	5	1.38	80	80	80	251,075
March..... ..	736.25	644,640	78,001,440	7.35	19,288	1,06 .840	79,062,280	2,550,396	9	7.37	80	80	80	1,287,803
April	716.50	618 680	74,860,280	3.10	8,410	462,550	75,322,830	2,510,761	10	16.57	80	80	80	2,936,307
May..... ...	732 35	609,836	73,790,156	11.25	26,352	1,449,360	75 239,516	2,427,081	7	2.30	80	70	75	349,448
June	710.10	637,483	77,135,443	10.30	21,200	1 441,000	78,576,443	2,619,215	7	15.15	90	60	77	2,821,627
July.....	738.55	755,813	91,453,373	15.25	43,875	2,248, 25	93,701,498	3,022,629	16	24.11	70	70	70	6 426,484
August	740.50	735,100	88,947,100	3.'0	9,465	520,575	89,467,675	2.886.084	'3	4.38	70	70	70	776,336
September.....	720	675,948	81,789,708				81,789,708	2,726,324	7	9 47	70	70	70	1,654,554
October..... .	740.30	662 458	80,157.418	3,30	9,133	502,315	80 6(9,733	2,601,927	10	6.15	70	70	70	998,976
November....	720	631,412	76 763,852				76,763,852	2,558,795	6	2 17	70	70	70	316,899
December....	738.30	679,168	82,179,328	5.30	14 908	824,890	83,004,218	2,677,555	12	5.18	70	70	70	939,444
TOTALS...	8734.45	7,887,967	954.444.007	60.15	154,721	8,509,655	962 953 662	2,631,021	109	98.38	90	60	73.75	19,106,470

PUMPING PLANT.

BOILERS.

Three horizontal, return tubular boilers, 16 feet long, 5½ feet in diameter, 105 tubes of 2¾ inches interior diameter in each boiler, the boilers set in separate brick arches. Area of grate surface under No. 1 boiler, 27½ square feet; under No. 2 and 3 boilers, each 34 square feet. Heating surface of each boiler (½ shell, 138.24; tubes, 1,209.51), 1,347.75 square feet. Steam pressure carried, 65 pounds.

ENGINES AND PUMPS.

One Gaskill horizontal compound condensing crank and flywheel pumping engine, maximum capacity 5,000,000 gallons in 24 hours. One Holly Quadruplex, compound condensing, crank and flywheel pumping engine, maximum capacity 3,000,000 gallons in 24 hours. One horizontal, high pressure, piston engine, driving through gears, two No. 10 Holly rotary pumps, maximum capacity, 2,500 000 gallons in 24 hours.

Capacity of Gaskill pumps per revolution, 121 gallons.

Capacity of Quadruplex pumps per revolution, 55 gallons.

Capacity of Rotary pumps per revolution, 17 gallons.

MAIN DISTRIBUTION.

The distributing mains have been extended during the y follows:

A 20 inch, cast iron main in Washington avenue from 2nd streets.

A 16-inch, cast iron main in Washington avenue from 10th streets, thence across 12th street to the intersection of Fraser street, in Fraser street to 23rd street, thence in 23rd street to Water thence in Water street to the intersection of Harrison street ne street, thence in Harrison street to South Center street.

Fire hydrants have been connected with the 20-inch and 16-inc from the pumping station to South Center street as follows:

One Matthews 6-inch 3-way hydrant on Water Works yard, nea of dock.

One Matthews 6-inch 3-way hydrant in Belinda street, near the Belinda street bridge.

Eleven Matthews 6-inch 3-way hydrants along Water street, b the pumping station and Washington avenue.

Eleven Matthews 6-inch 3-way hydrants along Washington between Water street and 10th street.

Two Matthews 4-inch 2-way hydrants, and one Bourdon 6-inch hydrants along Washington avenue, between 10th and 12th streets.

Two Matthews 6-inch 3-way hydrants, seven Matthews 4-inch hydrants and one Holly Gaskill 4-inch 2-way hydrant, along Fraser between 12th and 23rd streets.

One Matthews 4-inch 2-way hydrant, and one Morgan 4-inch hydrant, along 23rd street, between Fraser and Water streets.

Two Matthews 6-inch 3-way hydrants in Water street, between 2 30th streets.

Four Matthews 6-inch 3-way hydrants in Harrison street, between 30th and South Center street.

In addition to the above described new hydrants set on this main, the following described hydrants were disconnected from the old mains and reset on connections from the new main:

The Holly hydrant at the corner of Belinda and Water streets.

The Matthews hydrant at the corner of 23rd and Stanton streets.

The Matthews hydrant at the corner of 23rd and Marsac streets.

The Holly hydrant at the corner of 24th and Water streets.

The Holly hydrant at the corner of 25th and Water streets.

The Holly hydrant at the corner of 28th and Water streets.

The Holly hydrant at the corner of 29th and Water streets.

The Holly hydrant at the corner of Fremont avenue and Water streets.

The Holly hydrant at the corner of 30th and Harrison streets.

The Holly hydrant at the corner of 33rd and Harrison streets.

The Holly hydrant at the corner of 34th and Harrison streets.

The following described hydrants were taken out and not reset, 6-inch 3-way hydrants being substituted:

The Holly hydrant at the corner of Water and Sherman streets.

The Holly hydrant at the corner of Water street and Washington avenue.

The Holly hydrant at the corner of 26th and Water streets.

The Holly hydrant at the corner of 27th and Water streets.

The Holly hydrant at the corner of 31st and Harrison streets.

The Holly hydrant at the corner of 32nd and Harrison streets.

The Holly hydrant at the corner of 35th and Harrison streets.

The Holly hydrant at the corner of South Center and Harrison streets.

Four of these hydrants taken out have been set in other parts of the city, hereinafter described, and four are in stock, to be used as required next season.

For the purpose of connecting the new cast iron main with intersecting pipes, the following described mains have been opened:

The 10-inch cast iron main in 10th street was cut at Washington avenue and reconnected with the side openings of a 20-inch by 10-inch cross.

The 10-inch Wyckoff main in Bowery was cut at 23rd street and reconnected with the side openings of a 16 by 10-inch cross.

The 6-inch Wyckoff pipe in Stanton street was cut near the north line of 23rd street and taken out to the curb line of the pavement; the 4-inch

pipe to the hydrant being also removed. The Stanton street p
connected with a 16 by 6-inch tee in the main, the hydrant bei
from the same branch. That portion of the Stanton street pi
under 23rd street pavement was adandoned.

The 4-inch Wyckoff pipe supplying the hydrant at the corner
and Marsac streets was taken out to the curb line, that portion lyi
the pavement being abandoned, and the hydrant reset from the b
the new main.

The 10-inch Wyckoff pipe in Water street was cut on both
23rd street pavement. On the north side to make way for the 16-in
and on the south side for a connection between the 16-inch main
10-inch Wyckoff main in 23rd street, put in in 1890. The Water st
was not connected with the new main, but the ends on the no
south sides of 23rd street were plugged and that portion of the pi
under 23rd street pavement abandoned.

The 10-inch Wyckoff pipe in South Center street was cut at
street and reconnected with a 16 by 10-inch cross in the new main

The 6-inch cast iron pipe in Campbell street has been exten
across Sherman street, and a new Matthews hydrant set at the n
corner of Campbell and Sherman streets.

A new Matthews hydrant has been set at the northwest corne
and Trumbull streets, and two old Holly hydrants taken up o
street, have been reset in Trumbull street, between Water str
Woodside avenue. Two old Holly hydrants taken up on Wate
have been set in Second street, one at the corner of Chase street,
other at Pendleton street. The branches for the last five
mentioned were put in when the main pipe was laid in 1886.

A 6-inch Wyckoff main pipe has been laid in 12th street, from
ren to Sherman streets, and the Matthews hydrant taken out in
River street, south of South Center street, was set on this line, at th
east corner of 12th and Farragut streets.

As the 4-inch Wyckoff pipe in the alley between Saginaw str
Washington avenue was in the way of the foundation of the new c
it was cut near the south line of Ninth street, the end north of c
plugged, and the pipe being abandoned from Ninth street, sout
main in Tenth street, that portion lying within the city hall fou
being removed.

Total length of pipe laid during the year:

KIND OF PIPE.	20-in.	16-in.	10-in.	8-in.	6-in.	4-in.	TOTAL
Cast Iron	3,255	12,311	46½	80	283½	318½	16,224½
Wyckoff	....	....	25¾	...	846¾	16	888¼
Total	3,255	12,311	72¼	80	1,110	334½	17,112¾

Length of pipe taken out and abandoned:

KIND OF PIPE.	10-in.	6-in.	4-in.	TOTAL
Cast Iron	10	2	8	20
Wyckoff	84¼	61½	386½	532¼
Total	94¼	63½	394½	552¼

Length of pipe in service December 31st, 1892:

SIZE OF PIPES.	CAST IRON.	WYCKOFF.	TOTAL.
20-inch	9,563 feet	.....	9,563 ft.
16-inch	13,778 "	.....	13,778
12-inch	9,083 "	.....	9,083
10-inch	8,739 2-12	34,140 4-12 ft	42,879 6-12
8-inch	2,108 5-12	27,038 9-12	29,147 2-12
6-inch	2,563 6-12	86,827 6-12	89,411
4-inch	1,096 9-12	21,723 4-12	22,820 [illegible]-12
3-inch	.....	319	319
Total	46,951 10-12	170,048 11-12	217,000 9-12 ft

Total cast iron mains, 8 miles, 4711 10-12 feet.
Total Wyckoff mains, 32 miles, 1088 11-12 feet.
Total mains 41 miles, 520 9-12 feet.

VALVES.

Valves have been set in the distributing mains laid during the
follows:

VALVE.	20-in.	16-in.	10-in.	8-in.	6-in.	4-in
Flower Patent.....	1	7	4	2	22	24

One of the 6-inch valves is a blow-off gate.

Valves taken out:

VALVE.	10-in.	4-in
Flower Patent.....	1	3

Total valves in use in the distributing mains:

VALVE.	20-in.	16-in.	12-in.	10-in.	8-in.	6-in.	4-in.	3-in.
Flower Patent.....	4	9	3	36	43	148	317	5
Galvin Patent.....			2	1	1	5	45	
Brown Patent.....			1			1		
Total.....	4	9	6	37	44	154	362	5

Blow-off gates included in above:

Three.....6-inch.
Seventeen.....4 "
Two.....3 "

FIRE HYDRANTS.

The number of fire hydrants put in during the year was 48
following descriptions:

Matthews, with 6-inch inlet, 3 hose nozzles, gates to nozzles	32
Matthews, with 4-inch inlet, 2 hose nozzles	13
Bourbon, with 6-inch inlet, 3 hose nozzles, gates to nozzles	1
Holly Gaskill, with 4-inch inlet, 2 hose nozzles	1
Morgan, with 4-inch inlet, 2 hose nozzles	1
	48

Four Holly hydrants have been taken out and not reset.

Total number of fire hydrants in service December 31st, 1892, was 352, of the following descriptions:

Matthews,	6	inch	inlet,	3	hose	nozzles with gates to nozzles	32
"	4	"	"	2	"	"	169
Holly,	4	"	"	2	"	" " " "	5
"	4	"	"	2	"	"	122
Gaskill,	4	"	"	2	"	"	15
"	Improved,		4-inch	inlet,	2	hose nozzles	1
Bourbon,	6	inch	inlet,	3	hose	nozzles with gates to nozzles	1
Galvin,	4	"	"	2	"	"	5
Morgan,	4	"	"	2	"	"	1
Brown,	4	"	"	2	"	"	1
							352

In addition to the pipe and valves above described, there have been put in during the year, for the purpose of connecting fire pipes on private premises with the new main, the supply to said pipes having been disconnected from the old main:

47 feet of 4-inch cast iron pipe.
44 feet of 2-inch cast iron pipe.

Also:

Four 4-inch valves.
Two 2-inch valves.

All of the fire hydrants and all supplies to private premises for fire protection having been disconnected from the old main in Water and Harrison streets, from Twenty-third street to South Center street, the connections between this pipe and the other mains have been closed, except through the 6-inch pipe entering at Twenty-fourth street, and a 4-inch Mueller pressure regulating valve has been placed in this pipe in the alley between McCormick and Wilson streets, just south of its connection with the main in Twenty-third street. This valve is set to give a pressure of 30 pounds per square inch in the Water and Harrison street main.

WATER METERS.

The number of meters set during the year was 99, and the n
taken out 33, making the whole number of meters set and in use I
ber 31st, 1892, 393. One elevator indicator and one motor indicato
been abandoned, meters having been substituted, leaving but one
tor indicator in service.

The meters set during the year were as follows:

METERS.	3-in.	2-in.	1½-in.	1-in.	¾-in.	⅝-in.	½-in.	⅜-in.
Union Rotary	3		1	1		22		
Crown				1	4		2	13
Empire					3		3	
Worthington		2				1		
Hersey						7		
Thomson				1		35		
Total	3	2	1	3	7	65	5	13

The meters taken out were:

METERS.	3-in.	2-in.	1½-in.	1-in.	¾-in.	⅝-in.	½-in.
Union Rotary	2		1	1		1	
Union Duplex						3	
Crown				2	2		
Empire					5		5
Worthington		1				1	
Hersey							
Thomson				3		3	
Total	2	1	1	6	7	11	5

Meters in service December 31st, 1892:

METERS.	8-in.	4-in.	3-in.	2-in.	1½	1-in.	¾-in.	⅝-in.	½-in.	⅜-in.	TOTAL
Union Rotary.....	1	5	20	6	3	2	1	30			68
Union Duplex.....								19			19
Crown.....					1	20	33		27	14	95
Empire.....						6	32		21		59
Worthington.....				5	6			10			21
Hersey.....						2	5	25			32
Thomson.....							1	98			99
Total.....	1	5	20	11	10	30	72	182	48	14	393

Also one elevator indicator.

Manufacturing meters, 90; domestic, 297; Test, 6.

The total cost to the department for 393 meters set and in use is $12,666.62; value of meters and fittings in stock, $1,041.74; labor etc. on account of meters taken out and not replaced, $505.55. The total amount charged to meter department, $14,213.91.

The quantity of water supplied through meters during the year was 108,716,900 gallons, which is about 14,000,000 gallons less than in 1891. The supply to elevator in the Phoenix block was discontinued in February, after using about 5½ million gallons from the commencement of the meter year (December 15th, 1891). This elevator used in 1891, 27,941,675 gallons, showing a direct loss from this consumer of more than 22 million gallons. This service was discontinued at the request of the board, on account of the manner in which the water was used. Aside from the loss on this service, the increase in water supplied through meters was about 8,000,000 gallons.

The quantity of water supplied through manufacturing meters was 67,452,882 gallons, and the amount charged on the roll therefor was $5,914.90, an average of about 8 4-5 cents per 1,000 gallons. The quantity supplied through domestic meters was 41,264,018, and the amount charged on the roll for the same was $4,510.42, or nearly 11 cents per 1,000 gallons. The excess above ten cents per 1,000 gallons is due to the fact that the consumption through a number of domestic meters was less than the minimum quantity charged for.

The total amount collected for water supplied through meters was $10,250.13, and the amount uncollected at the close of the year $175.19, making the total amount charged for metered water $10,425.32, an average of 9½ cents per 1,000 gallons.

The use of meters is rapidly growing in favor among co
most of those put in during the past year having been set at their
When meters are set at the request of the user the meter is furni
this department, but the cost of setting is paid by the consum
rates for water actually used through domestic services are less t
than the assessment rate, and there is no benefit to the depart
placing meters on services where the water is used in a proper man
the fixtures kept in order. The consumer we want to reach
meter is the one who does not want a meter, but persistently waste
and will not keep his fixtures in order. In these cases the dep
has to set the meter, and there has been but little opportunity du
past year to attend to this work. It is hoped that more satisfact
gress may be made during the coming season in reaching this class
sumers.

SERVICE CONNECTIONS.

The number of new service connections made with the main pi
ing the year was 88, of which 80 were made with corporation sto
8 were branch connections for fire pipes. Nine service connectio
corporations and five branches) were put in to replace connection
out or abandoned.

The number of connections taken out was 10, and 12 were abs
but not removed.

The number of new service connections made with privat
was 6.

The number of services added was 93, and one service he
reported abandoned was renewed, and the total number of service
doned was 19. The total number of separate services Decemb
1,886, of which 1,454 were open and 432 closed at the curb.

The service connections put in during the year were as follows

CONNECTIONS.	BRANCHES.		CORPORATIONS.			
	4-in.	2-in.	1-in.	¾-in.	⅝-in.	½-in
In Cast Iron mains	4	4	2		2	4
In Wyckoff mains				11	37	24
Total	4	4	2	11	39	28

The 2-inch connections were made with 4-inch branch castings reduced to 2-inch immediately after leaving the main

Service connections taken out:

CONNECTIONS.	2-in.	1¼-in.	¾-in.	½-in.	TOTAL
From Cast Iron mains		1			1
From Wyckoff mains	1		3	5	9
Total	1	1	3	5	10

Total service connections in main pipes December 31st, 1892:

MAINS.	BRANCHES.					CORPORATIONS.							TOTAL
	8-in.	6-in	4-in.	3-in.	2-in.	2-in.	1¼	1-in.	¾-in.	⅝-in.	½-in.	⅜-in.	
Cast Iron		2	13		4	2	5	50	58	87	94	5	270
Wyckoff.	1	3	14	1	1	8		431	192	369	528		1548
Total..	1	5	27	1	5	10	5	481	250	406	622	5	1818

Of these connections 101 are abandoned and shut off at the main, leaving 1717 with services connected.

Total amount paid during the year for service connections and tools including one Mueller tapping machine, $245.56. The amount received for service connection permits was $281.00.

GENERAL REPAIRS—MAIN DISTRIBUTION.

The number of leaks in the main distribution system found and repaired were 54, all in Wyckoff mains. New sections of pipe were required in the repair of 19 of these leaks, the others were slight leaks, usually in joints, and were repaired by plugging.

The location and character of the leaks were as follows:

DATE.			MAIN PIPE.		CHARACTER.	HOW RE
Feb.	24,	1892	10-in.	Water street at 29th	Joint,	Plugge
Mar.	8,	"	6 "	Fraser street at 12th	Knot,	"
Mar.	10,	"	8 "	Alley bet. Jefferson and Madison	Joint,	"
April	5,	"	6 "	Park ave. at Naboabish	Knot,	"
"	25,	"	10 "	Water st. at 19th	Burst,	New pi
"	25,	"	8 "	18th st	Joint,	Plugge
"	27,	"	10 "	Water st. bet. 18th and 19th	"	"
May	2,	"	6 "	Water st. bet. 5th and Center	"	"
"	4,	"	10 "	Water st. at Fremont ave	"	"
"	28,	"	4 "	N. side Center, e. of Saginaw st	Burst,	New pi
June	1,	"	10 "	Water st. at 29th	Joint,	Plugge
"	2,	"	8 "	Harrison st. bet. 38th and 39th	"	"
"	17,	"	6 "	Water st. at 6th	Old sleeve,	New sl
"	17,	"	6 "	22nd st. at VanBuren	Joint,	Plugge
"	17,	"	8 "	Harrison st. bet. 38th and 39th	"	"
"	18,	"	8 "	Harrison st. bet. 32nd and 33rd	Burst,	New pi
"	21,	"	8 "	Alley bet. Jefferson and Madison	"	"
"	22,	"	6 "	S. side Center, e. of Saginaw st	"	"
"	22,	"	8 "	Alley bet. Jefferson and Madison	"	"
"	22,	"	4 "	Alley bet. Madison and Monroe	"	"
"	24,	"	6 "	Water st. bet. 9th and 10th	"	"
"	24,	"	6 "	Alley bet. Monroe and Jackson	"	"
"	25,	"	6 "	Lincoln ave. at 6th	Knot,	Plugge
"	29,	"	10 "	Water st. at 29th	Joint,	"
July	5,	"	4 "	Farragut st. bet 6th and 8th	Burst,	New pi
"	7,	"	8 "	11th bet. Jefferson and Madison	Joint,	Plugge
"	8,	"	6 "	S. side Center, e. of Adams	Old sleeve,	New sl
"	18,	"	8 "	Alley bet. Jefferson and Madison	Joint,	Plugge
"	19,	"	6 "	Alley bet. Washing'n and Adams	Burst,	New pi
"	22,	"	8 "	Harrison st. bet. 33rd and 34th	Joint,	Plugge
"	25,	"	6 "	Alley bet. Washing'n and Adams	Burst,	New pi
"	27,	"	8 "	VanBuren st. bet. 13th and 14th	Knot,	Plugge
"	28,	"	10 "	Water st. bet. 17th and 18th	Joint,	"
"	28,	"	8 "	18th st	"	"
Aug.	5,	"	6 "	Park ave. n. of 12th st	Knot,	"
"	9,	"	8 "	Harrison st. at 34th	Joint,	"
"	23,	"	8 "	Harrison st. bet. 40th and 41st	Burst,	New pi
"	27,	"	8 "	18th st	Joint,	Plugge
"	29,	"	8 "	Alley bet. Jefferson and Madison	Knot,	"
"	30,	"	10 "	Water st. bet. 25th and 26th	Joint,	"
Sept.	1,	"	8 "	Harrison st. at 34th	Burst,	New pi
"	10,	"	6 "	S. side Center ave. at Jackson	Joint,	Plugge
"	21,	"	8 "	Alley bet. Jefferson and Madison	"	"
"	26,	"	6 "	Water st. bet. 9th and 10th	"	"
"	27,	"	10 "	Water st. at 25th	"	"
Oct.	4,	"	8 "	Alley bet. Jefferson and Madison	Burst,	New pi
"	6,	"	8 "	Harrison st. at 33rd	Joint,	Plugge
"	7,	"	10 "	Bowery bet. 19th and 21st	"	"
"	13,	"	10 "	Water st. bet. 17th and 18th	"	"
"	17,	"	4 "	Alley bet. Madison and Monroe	Burst,	New pi
"	21,	"	10 "	Water st. at 18th	Joint,	Plugge
Nov.	7,	"	8 "	18th st	"	"
"	28,	"	6 "	Fitzhugh st. bet. 21st and 22nd	Knot,	"
Dec.	30,	"	8 "	Harrison st. at 41st	Burst,	New pi

The cost of repairing these leaks was:

For labor	$ 186 38
For material	69 90
For relaying stone sidewalks	11 40
	$ 267 68

It has been necessary to take out sections of pipe at two points to make way for sewers. The cost of taking out these pipes and reconnecting them over the sewers was $48.32.

The pipe on the west side of Water street, between Fifth and Center streets, has been twice placed in dangerous condition by the caving in of area walls, and by excavating for areas for new buildings. The cost of replacing these pipes and protecting them against future danger was $42.10.

Thirty-seven old valve boxes have been replaced with cast iron extension boxes, at a cost of $169.80.

Two valves in the distributing mains have been broken in service and required new stems. Eight valves for the new mains were lying on the street in the path of the fire of July 25th and were injured by the heat to such an extent as to necessitate their return to the manufacturers for repairs.

All of the fire hydrants were carefully inspected twice during the year, once in the spring and once in the fall; the accumulations of sediment in the hydrant branches blown out and the main pipes thoroughly flushed out through them; the working parts of the hydrants lubricated and such as showed any defects placed in good order. In addition to these regular semi-annual inspections, during the cold weather a continuous examination is made for frozen hydrants. During the months of January, February and March the employes of this department found 23 hydrants frozen to such an extent as would have seriously delayed the fire department had their use been required when in that condition. All defects of this nature were found and remedied by this department, and at no time was the work of the fire department impeded by defective hydrants. Seven hydrants have been accidentally broken during the year, requiring new parts, and a large number have required minor repairs, new gaskets, waste holes opened, etc.

The hydrant on Fourth street between Jefferson and Madi and the one on the corner of Tenth and Jackson streets, have by inserting extension pieces in the body to bring to grade co to the new pavement on these streets, and the hydrant on th corner of Fourth and Washington streets was moved outside o line of pavement on Fourth street.

The entire amount paid for repairs on valves and hydrant inspections, was $319.12. The cost of cutting the pipe in the al Saginaw and Washington streets, rendered necessary by the exc the new city hall, was $3.25

Total amount paid for repairs on the main distribution syst

At a session of the common council held November 14th, 1 lution was adopted "directing the superintendent of water wor the hydrants directly into the sewers through hose or otherwis no event to throw water on the streets or alleys." This resol pels us to abandon the system of flushing out the pipes throug as a very large percentage of the fire hydrants are located s from the catch-basins as to render it entirely impracticable to and when the fire hydrants are so located as to reach a catch-b short length of hose, the pipes cannot be properly flushed in th On many of the lines of pipe where the quantity of water us and the circulation defective, it is often necessary to remove from the hydrants, and let it run at full pressure for a half ho before the pipe is cleared. The only reason given for the adop resolution above quoted was, that some of the pavements had b by the current of water from the hydrants washing out the between the cobblestones in the gutters. The facts are that in t few hydrants located on streets newly paved where the cobbl ters had not been thoroughly packed, the water had washed o face sand, but in no case were the stones loosened, and as m was called to the matter, all of the damage was repaired in an h by one man with a shovel, simply replacing the sand.

SERVICES.

The number of services shut off by this department durin was 316, and the number turned on 317. Of the services shut o closed at the request of the customer, 133 were premises found were closed for leaks, and 100 for non-payment of water rates.

Three private mains supplying several consumers have been found leaking, and repaired by this department, also two lead services broken through the carelessness or neglect of sewer contractors. The total cost of repairs and care of services including inspection, and turning on and off was $382.21.

METERS.

The number of meters found broken, and taken out for repairs was 34, and 54 meters were found not registering properly but unbroken, these were cleaned, tested and replaced. Most of the repairs on broken meters were made by the inspector, but two having been returned to the manufacturers. None have been broken beyond repairs.

Duplicates of those parts of the meters which have been found most liable to breakage, are kept on hand to facilitate the prompt completion of repairs.

The total cost of keeping the meters in repair, including the monthly inspection of all meters was $387.38.

Appended hereto are the usual summary of statiatics and tables showing uses for which water is supplied.

Respectfully submitted,

E. L. DUNBAR,
Superintendent and Secretary.

Office Board of Water Works.
Bay City, Mich., February 20th, 1893.



SUMMARY OF STATISTICS.

REPORT OF 1892.

Water Works of Bay City, Bay County, Michigan.
Built in 1872.
Owned by the city.
Source of supply, Saginaw Bay, an arm of Lake Huron.
Mode of supply, direct pumping.

PUMPING.

1. Builders of pumping machinery, Holly Manufacturing Compa
2. Kind of fuel, pine slabs and edgings.
3. Fuel consumed: 2,692 cords edgings, cost $1,757.40; 47 700-2000 t
   cost $118.39; total $1875.79.
6. Total water pumped in gallons, 962,953,662.
8. Average dynamic head, 113½ feet.
9. Gallons pumped per pound of coal, 611.
10. Duty= $\frac{962{,}953{,}662 \times 8.34 \times 100 \times 113\frac{1}{2}}{1{,}575{,}300}$ =57,863,412.

    Cost of pumping, based on pumping station expenses, $5,924.1
11. Per million gallons pumped, $6.15.
12. Per million gallons raised one foot, $0.0542.

    Cost of pumping, based on total maintenance, including inter
    by city, $41,192.86.
13. Per million gallons pumped, $42.77.
14. Per million gallons raised one foot, $0.377.

CONSUMPTION.

1. Estimated population to date, 33,000.
2. Estimated population on pipe lines, 19,000.

3. Estimated population supplied, 13,500.
4. Total gallons supplied, 962,953,662.
5. Passed through domestic meters, 41,264,018 = 4¼ per cent.
6. Passed through manufacturing meters, 67,452,882 = 7 per cent.
7. Average daily consumption, 2,631,021.
8. Gallons per day to each inhabitant, 80.
9. Gallons per day to each consumer, 195.
10. Gallons per day to each service (distribution 22) 1532.

DISTRIBUTION.

MAINS.

1. Material, cast iron and Wyckoff patent.
2. Size, 3-inch to 20-inch.
3. Extended, 17,112 feet.
4. Abandoned, 552 feet.
5. Total in use, 41 miles.
6. Cost of repairs, $20.75 per mile.
7. Leaks per mile, 1½.
8. Small distribution, less than four inches, 319 feet.
9. Hydrants added, 44.
10. Number of hydrants in use, 352.
11. Stop gates added, 56.
12. Number in use, 621.
13. Number of small gates, less than 4-inch, 5.
14. Number of blow-off gates, 21.
15. Ranges of pressure at center, day and night, 35 to 38 pounds.

SERVICES.

16. Material, lead, wrought iron and Wyckoff patent.
17. Sizes, ⅝-inch to 8-inch.
21. Service taps added, 62.
22. Number in use, 1717.
25. Meters added, 66.
26. Number in use, 393. Domestic, 297; manufacturing, 90; test, 6.
27. Motors and elevators added, 11.
28. Number in use, 56.

FINANCIAL.

MAINTENANCE.

RECEIPTS.—DIVISION I.

A	Water rates, domestic	$17,765 22
B	Water rates, manufacturing	6,474 89
C	Net receipts from water rates	
D	Miscellaneous service connections, etc.	
E	Total	
	From Public Fund:	
J	Tax levy for interest	

DIVISION II.

	From Fixed Rates:	
L	Domestic	$19,293 47
M	Manufacturing	619 77
N	Total	
	From Meter Rates:	
O	Domestic	$ 4,471 75
P	Manufacturing	5,855 12
Q	Total	

EXPENDITURES.

AA	Management and repairs	$11,302 86
BB	Interest paid by City	29,710 00
	Interest paid by Water department	180 00
CC	Total maintenance for year	
	Bills payable	
DD	Balance to construction	

CONSTRUCTION.

R	Balance from previous year	$24,408 08	
	Balance from maintenance	8,773 25	
	Received from pipe, etc. sold	209 52	
	Total	$33,390 85	
FF	Extension of mains	$20,785 44	
HH	Water meters	1,197 15	
II	Total for construction		$21,982 59
	Balance		11,408 26
	Total		$33,390 85

W	Net cost of Works to date	$542,840 03
X	Bonded debt	392,000 00



USES SUPPLIED AT FIXED RATES.

1 Ashery.
4 Bakeries.
1 Bank.
5 Barber shops.
2 Bath rooms (public.)
1 Bath room (Turkish.)
237 Bath rooms (private.)
7 Blacksmith shops.
8 Boarding houses.
10 Boilers (for power.)
8 Bottling works.
1 Broom factory.
15 Business blocks.
1 Business college.
7 Butcher shops.
2 Canning works.
1 Carpet cleaning.
3 Carriage works.
1 Cemetery.
3 Churches.
2 Cigar factories.
2 Clothes cleaning.
704 Dwellings.
1 Express offices.
90 Families in blocks.
3 Fire pipes.
1 Foundry.
3 Fountains.
1 Gas works.
3 Gas engines.
6 Halls (public.)
3 Harness shops.
400 Hose for sprinkling.
23 Hotels.
1 Laboratory.
3 Laundries.
3 Machine shops.
19 Offices.
1 Paint shop.
1 Passenger depot.
1 Pasture.
3 Photograph galleries.
3 Plumber shops.
1 Post office.
1 Printing office.
2 Refrigerators.
10 Restaurants.
62 Saloons.
1 Salt crusher.
14 Schools.
7 Stables (livery.)
7 Stables (mill.)
130 Stables (private.)
1 Stone yard.
89 Stores.
1 Tailor shop.
1 Telegraph office.
1 Undertaker.
736 Water closets and urinals
60 Water closets in schools.
8 Water moters.
3 Warehouses.

USES SUPPLIED THROUGH METERS.

2 Bakeries.
161 Baths (private.)
1 Bath room (public.)
3 Bottling works.
21 Business blocks.
45 Boilers (for power.)
6 Box factories.
1 Brewery.
2 Boarding houses.
2 Boiler shops.
2 Barber shops.
4 Banks.
2 Butcher shops.
1 Business College.
1 Carpet cleaning.
1 Cemetery.
4 Churches.
1 Club room.
1 Coal and wood yard.
1 Cooper shop.
1 County jail.
1 Court house.
1 Cracker factory.
1 Cross arm factory.
1 Crystal water works.
230 Dwellings.
5 Drill houses.
1 Dry kiln.
1 Electric light station.
3 Elevators.
1 Excelsior factory.
25 Fire pipes.
2 Flouring mills.
4 Foundries.
2 Gas engines.
1 Green house.
180 Hose for sprinkling.
18 Hotels.
8 Halls.
1 Locomotive stand pipe.
2 Laundries.
8 Machine shops.
25 Offices.
1 Opera House.
2 Passenger depots.
1 Photograph gallery.
1 Plumber shop.
10 Planing mills.
1 Pipe factory.
1 Plow factory.
2 Printing offices.
1 Reel factory.
2 Restaurants.
1 Round house.
6 Saloons.
11 Salt blocks.
1 Sash and door factory.
13 Saw mills.
6 Stables (livery.)
2 Stables (street car.)
7 Stables (mill.)
54 Stables (private.)
2 Stables (hotel.)
1 Stable (bus and hack.)
1 School.
580 Water closets.
48 Water motors.
2 Warehouses.
1 Woodenware works.

Material Used in Running Pumping Engines.

2,692 cords wood	cost	$1,757 40
47 700-2000 tons coal	"	118 39
163 8-10 gallons cylinder oil	"	74 72
32 lbs. lubricant	"	4 80
1 gallon lard oil	"	53
8½ lbs cotton packing	"	1 80
6½ lbs. hemp	"	1 30
1 lb. § in square rubber	"	58
48½ lbs. 1 in. square rubber	"	28 13
3¼ lbs. Heston packing	"	4 87
3 lbs. Goodsell packing	"	4 50
8½ lbs. Eureka packing	"	4 25
1¼ lbs. sheet rubber	"	31
1 lb. boiler gasket	"	72
¼ lb wicking	"	05
502 lbs. wipers	"	20 30
4½ lbs. tripoli	"	40
1 lb rotten stone	"	08
17 boxes concentrated lye	"	1 63
Soap	"	3 30
¼ lb. emery	"	04
11 brooms	"	2 67
9 sheets emery cloth	"	38
535 gallons kerosene oil	"	31 45
20 lamp chimneys	"	1 03
3 lamp reflectors	"	75
1 doz. lamp wicks, 15c.; 80 boxes matches, 91c.,	"	1 06
10 lbs. rivets, 90c., 33¼ lbs. leather, $9 38	"	10 28
Sheet copper, tools, etc	"	35 00
Ice for season	"	12 25
Total		

Twenty-Second Annual Report

of the

Water Department

of

BAY CITY, MICHIGAN.

DECEMBER 31st,

1893.

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OF THE

Boston Society of Civil Engineers.

No......

Received .....

PRESENTED BY

.....

RULES.

Books and periodicals may be used in the Reading-Room by members and friends, and by students recommended by the Boston Public Library.

Members may borrow books for home use, but no one shall have more than four books at any time, nor keep any book more than five weeks.

A member borrowing a book shall give a receipt therefor to a member of the Library Committee, to the Secretary, or to the regular attendant.

A fine of one cent per day per volume shall be charged for overtime, and must be paid before the delinquent can take any more books.

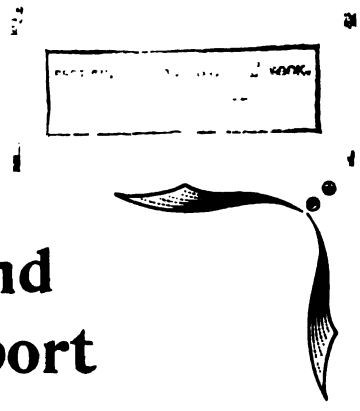
Current numbers or unbound files of periodicals shall not be taken from the room.

Books of unusual value are marked with a star (*), and must not be taken from the room, except by written permission from the Board of Government.

Any person mutilating or losing a book shall pay for the damage, or replace the book.

Any one who violates the above rules shall, upon written request from the Librarian to the Board of Government, be debarred from the privileges of the library for such time, not less than three months, as the Board of Government may determine.

(Adopted Nov. 18, 1896.)



Twenty-Second Annual Report

of the

Water Department

MPLIMENTS OF

E. L. DUNBAR,

SUPERINTENDENT.

PLEASE EXCHANGE.

DECEMBER 31st,

1893.

HURLEY BROS., PRINTERS & BINDERS, BAY CITY, MICH.

Bay City, Michigan.

Water Departmen

1894.

Commissioners.

ANDREW WALTON, PRESIDENT.
(Term expires Sept. 6th, 1894.)

G. HENRY SHEARER.
(Term expires Sept. 6th, 1895.)

BENJAMIN F. RAY.
(Term expires Sept. 6th, 1896)

SANFORD V. WILKIN.
(Term expires Sept. 6th, 1897)

LOUIS MORITZ.
(Term expires Sept. 6th, 1898)

DUNCAN McGREGOR.
(Term expires Sept. 6th, 1899)

FREMONT J. TROMBLE.
(Term expires Sept. 6th, 1900)

Officers.

Supt. & Secy.....E. L. DUNI

Office Assistant,.....T. A. DELZ

Inspector,.....FRANK H. C

Reservoir Keeper,.....L. D. CARPE

First Engineer,.....A. B. VERIT

Second Engineer,.....JAMES E. D

Firemen,.....JAS. H. McG
PATRICK O'

Superintendent's Report.

TO THE HONORABLE BOARD OF COMMISSIONERS OF WATER WORKS OF BAY CITY, MICHIGAN:

GENTLEMEN:—I respectfully submit the report of the water department of this city for the year ending December 31st, 1893.

The financial depression which has prevailed throughout the country during the year has had its effect upon this department as is shown by a decrease of more than $1,000.00 in the receipts. Nearly one fourth of the services in the city are shut off, either for non-payment of rates, premises vacant or at the request of consumer.

Two new boilers have been added to the pumping plant during the year. All of the pumping engines can now be run to their full capacity in case of emergency provided sufficient water can be brought into the wells to supply them; if it should be necessary to run the works to their full capacity at a time when the wind is blowing very hard from the south-west, thereby lowering the water in the bay and river, it would be impossible for both the bay and river inlets to supply all the water the pumps could deliver.

During the latter part of the summer the quality of the supply has been much better than ever before in the summer; this is probably due, to a great extent, to the construction of the large log boom just east of the mouth of the river and the consequent deflection of the river currents from following the east shore of the bay and carrying them more directly out into the bay. Should another year's experience prove that this is a permanent benefit to the water supply from its present source it will obviate the necessity for changing the source of supply to the west shore of the bay, and also the necessity for extending the inlet any considerable distance into the bay, as, if the inlet were extended beyond the point where it

would be protected from the river currents by the boom, the re
be more of a damage than benefit.

The record of water pumped as indicated by the revoluti
pumping engines show an increase in the quantity of water s
the city of more than 80 million gallons over the year 1892. The
there has been considerably less water used for manufacturing
than during the preceding year, as shown by the manufacturin
under meter, also, that careful investigation has failed to dis
material increase in the waste of water or any serious leakage,
the improbability of any such increase in the quantity actually
and is evidence that the record of an engine counter cannot be re
for an accurate statement of the quantity of water delivered.
duction of a small quantity of air into the cylinder of a pum
operation is beneficial, making the pumps work smoothly, and
the quality of the water; but when the quantity of air admitted is
it increases the speed of the pumps very perceptibly, and gives
a milky appearace when first drawn from the faucet. This milk
ance has been repeatedly noticed during the year, and to a grea
than for many previous years, and accounts to some extent for
ent increase in the quantity of water delivered.

The cost of operating the works has been about $1,300 more
the year 1892. This increase has been entirely in the cost of f
the quantity of fuel burned has not been greater than during t
ing year, it was not possible to purchase at the same price as h
That such would be the case was apparent early in the year,
the supply of fuel carried over was exhausted a test was made
Sebewaing coal and Ohio coal these tests running through t
of March and April. The result showed that the use of eithe
coals would involve a cost for fuel for operating the works of
double that paid previously for slabs and edgings from the
Proposals were consequently invited from the mills in the imm
cinity of the pumping station for supplying fuel for the ensu
Owing to the fact that some of these mills had not secured a
logs for the season, and could not say what portion of the time t
be in operation, but one offer was received, and this at a pr
would make the cost of the fuel delivered in the fire room exac
what it had been costing. As this would still leave the cost bel
coal, the offer was accepted and the use of slabs and edgings has

tinued. Another test is now being made with coal under the new boilers with a view to determining whether this fuel can be used with more economy in the new arches than the old ones.

Nearly all of the new services put in during the year have been placed under meter, but little progress has been made in metering old services. Every inspection shows a large number of water closets running constantly. There is no doubt that this class of leakage embraces a very large percentage of the total quantity of water supplied in this city, and there is one, and but one, way of effectually controlling this leakage; that is by placing a meter on every service where such leakage is found.

The expenditure of about $3000 in placing meters upon services supplying this class of fixtures would have more effect in rendering the use of river water unnecessary than the expenditure of many times this amount in any other direction.

FINANCIAL.

RECEIPTS.

The receipts of the department during the year were
follows:

From water rates roll of 1890	$
From water rates roll of 1891	
From water rates roll of 1892	
From water rates roll of 1893	
Total from water rates	
From plumbers' licenses	$
From service connections	
From repairs on services	
From repairs on main distribution	
From oil and packing account	
Total miscellaneous receipts	

This amount has been deposited with the City Treasu
ceipts on file as follows:

January 31st.	1893	$
February 28th.	"	
March 31st.	"	
April 29th	"	
May 31st	"	
June 30th.	"	
July 31st.	"	
August 31st	"	
September 30th.	"	
October 31st.	"	
November 30th	"	
December 30th.	"	

*Does not include $2 25 water rates returned to consumer in July.

The total amount charged on roll of 1893 was $24,160 17 as follows:

For water supplied at fixed rates	$13.020 18
For water supplied at meter rates	11.067 14
For water supplied for building purposes	72 85
	$24.160 17

The amounts collected on the roll of 1893 were:

From fixed rates	$12.470 53
From meter rates	10.770 75
From building purposes	32 55
	$23.273 83

The amount uncollected on roll of 1893 at the close of the year:

From fixed rates	$549 65
From meter rates	296 39
From building purposes	40 30
	$886 34

The amounts collected during the year from previous years rolls were:

From fixed rates	$55 41
From meter rates	30 20
From building purposes	36 35
	$121 96

The following table shows amount collected and uncollected on each year's rolls since the works commenced operations:

YEARS.	COLLECTED.	UNCOLLECTED	Total on Roll.
1873--January 1st to April 30th	728 82		728 82
1873-4 May 1st, 1873 to April 30th, 1874	5,440 80	1 60	5,442 40
1874-5 May 1st, 1874 to April 30th, 1875	6,908 16	44 85	6,953 01
1875-- May 1st to December 31st	7,269 55	28 46	7,298 01
1876	9,571 26	82 73	9,653 99
1877	9,604 26	134 19	9,738 45
1878	10,078 15	324 71	10,402 86
1879	11,708 97	136 07	11,845 04
1880	13,155 74	120 25	13,275 99
1881	15,002 61	212 40	15,215 01
1882	17,352 47	158 85	17,511 32
1883	18,713 46	98 64	18,812 10
1884	18,892 02	132 64	19,024 66
1885	19,716 73	270 58	19,987 31
1886	19,348 61	126 74	19,475 35
1887	19,435 25	88 00	19,523 25
1888	21,266 45	132 97	21,399 42
1889	22,118 45	115 05	22,233 50
1890	23,282 74	217 88	23,500 62
1891	24,603 61	306 31	24,909 92
1892	24,121 73	345 37	24,467 10
1893	23,273 83	886 34	24,160 17
TOTALS	$341,593 67	$3,964 63	$345,558 30

EXPENDITURES.

The expenditures of the department for the year have b
for the following accounts:

For maintenance accounts:

OFFICE DEPARTMENT:	
Supt. and Secy's salary	$1,800
Office assistant	800
Office expenses	423
STREET AND SERVICE DEPARTMENT:	
Repairs on main distribution	806
Repairs on services and turning on and off	346
Repairs and care of meters	574
Repairs and care of inlet works	432
Service connections	125
PUMPING DEPARTMENT:	
Salaries of engineers and firemen	3,620
Fuel	3,187
Oil, packing and engineers' supplies	308
Repairs on engines and boilers	128
Repairs on boiler arches	40
REPAIRS ON BUILDING ETC.	
Repairs to engine house	17
Total for maintenance	

For construction accounts:

ENGINE HOUSE:	
Addition to boiler room	1,190
BOILER FOUNDATIONS AND ARCHES:	
Foundation for new boilers (2)	336
Arches for new boilers (2)	559
PUMPING MACHINERY:	
New boilers (2) with fittings etc	1,754
MAIN DISTRIBUTION:	
Cast iron pipes and specials	742
Wyckoff patent pipe	2,377
Valves	221
Fire hydrants	298
Laying cast iron pipe	503
Laying Wyckoff pipe	461
WATER METERS:	
New meters and fittings	682
Setting meters	87
Total for construction	

WATER WORKS FUND AND CITY TREASURER.

CITY WATER WORKS FUND:	DR.	CR.
To balance in fund January 1st 1893	$ 11,408 26	
" collections deposited by Secretary	23,827 54	
By amounts withdrawn on Recorder's Warrant—		
January 31st, 1893—Warrant No. 287, Statement No. 73		881 63
February 28th, " " " 288 " " 74		855 46
March 31st, " " " 289 " " 75		1,328 91
April 29th, " " " 290 " " 76		1,440 99
May 31st, " " " 291 " " 77		1,343 43
June 29th, " " " 292 " " 78		5,382 71
July 31st, " " " 293 " " 79		4,236 48
August 30th, " " " 294 " " 80		1,773 07
September 29th, " " " 295 " " 81		1,164 75
October 31st, " " " 296 " " 82		1,204 69
November 29th, " " " 297 " " 83		1,042 47
December 29th, " " " 298 " " 84		1,170 66
Balance in fund December 31st		13,410 55
	$35,235 80	$35,235 80

CITY TREASURER, AS TREAS. OF BOARD:	DR.	CR.
To Recorder's warrants on City Water Works Fund, Nos. 287 to 298 inclusive	$ 21,825 25	
By paid orders of Secretary Nos. 1,815 to 2,142 inclusive		21,825 25
	$ 21,825 25	21,825 25

Under instructions of the board embraced in a resolution adopted March 28th 1893, the Secretary included in the statement of claims for that month $142 64 to pay for certain labor performed in 1892 in laying the large iron main in Water street and Harrison street from 23rd street to South Center street; the liability of the board for the payment of which had been in question, the money was withdrawn from the city treasury to pay these claims, but two of the claimants having left the city before the matter was adjusted, and not having returned the amounts due them have not been called for and are retained in the office in currency to be paid when called for; the amount unclaimed is $24 30. This amount is included in the above statement of expenditures.

In addition to the expenditures as above stated, the City Treasurer has paid during the year from moneys raised by tax levy (City Bond and Interest Fund) the annual interest on out standing water works bonds, amounting to $28,910 (less coupon not presented) and has retired $10,000 00 of the original issue. Series No. 7 issued January 15th 1872 payable October 15th 1893. The total amount of water works bonds paid to date is

$70,000, and the amount out standing is $382,000. $20,000 o
will fall due in 1894. Series No. 8 issued January 15th 1872,
ber 15th 1894, amount $10,000; and Series No. 28 issued Octo
payable October 15th 1894, amount $10,000.

Water Works Bonds Outstandi

SERIES.	DATE OF ISSUE.	PAYABLE.	AMOUN
No. 8.....	January 15, 1872	October 15, 1894	$10,000
" 9.....	" " "	" " 1895	10,000
" 10.....	" " "	" " 1896	10,000
" 11.....	" " "	" " 1897	10,000
" 12.....	" " "	" " 1898	8,000
" 13.....	August " "	Febru'y 16, 1899	10,000
" 14.....	" " "	" " 1900	10,000
" 15.....	" " "	" " 1901	10,000
" 16.....	" " "	" " 1902	10,000
" 17.....	" " "	" " 1903	10,000
" 18.....	" " "	" " 1904	9,000
" 19.....	" " 1873	" " 1905	10,000
" 20.....	" " "	" " 1906	10,000
" 21.....	" " "	" " 1907	10,000
" 22.....	" " "	" " 1908	10,000
" 23.....	" " "	" " 1909	10,000
" 24.....	Febr'y 15, 1874	" " 1910	10,000
" 25.....	April 15, "	April 15, 1911	10,000
" 26.....	" " "	" " 1912	10,000
" 27.....	" " "	" " 1913	20,000
" 28.....	October 15 "	October 15, 1894	10,000
" 29.....	" " "	" " 1895	10,000
" 30.....	" " "	" " 1896	10,000
" 31.....	" " "	" " 1897	10,000
" 32.....	" " "	" " 1898	10,000
" 33.....	March 1st, 1875	March 1st, 1900	10,000
" 34.....	" "	" 1901	10,000
" 35.....	June 1st "	June 1st, 1902	10,000
" 36.....	" " "	" " 1903	10,000
" 37.....	" " "	" " 1904	10,000
NOT SERIED			
No's 1 to 25	May 1st, 1891	May 1st, 1906	25,000
" 26 to 50	" " "	" " 1911	25,000
" 51 to 63	" " "	" " 1917	12,500
" 64 to 76	" " "	" " 1918	12,500
			$382,000

The total amount of interest paid by the City on the
issued for the construction of Water Works to Decembe
$604,255.

LEDGER BALANCE, 1893.

LEDGER D.			
Folio 458, City Water Works Fund	$ 2,002 29		
" 475, Office Dept. Salaries	2,600 00		
" 476, Office Dept. Expenses	423 51		
" 480, Street and Service Dept. Repairs on main distribution	760 47		
" 478, " " " " repairs on services and turning on and off	340 13		
" 479, " " " " repairs and care of meters	574 56		
" 480, " " " " " " " " inlet works	432 12		
" 482, Repairs to Engine House	17 80		
" 483, Pumping Dep't, Salaries	3,620 00		
" 485, " " fuel	3,187 75		
" 487, " " oil, packing and supplies	307 72		
" 486, " " repairs to engine and boilers	128 28		
" 486, " " repairs to boiler arches	40 89		
" 494, Water Meters, new Meters and fittings	682 34		
" 494, " " setting meters	87 12		
" 489, Main distribution iron pipe and branches	742 42		
" 489, " " Wyckoff pipe	2,377 99		
" 490, " " Valves	221 35		
" 490, " " fire hydrants	298 00		
" 491, " " laying iron pipe	503 95		
" 491, " " laying Wyckoff pipe	461 27		
" 492, Engine house addition to boiler room	1,190 50		
" 492, Boiler foundations	336 00		
" 493, Boiler arches	559 58		
" 493, Pumping machinery	1,754 67		
" 472, Water rates Roll of 1890			3 00
" 471, " " Roll of 1891			24 85
" 471, " " Roll of 1892			94 11
" 470, " " Roll of 1893			23,273 83
" 473, Plumbers' licenses			35 —
" 481, Service connections			219 92
	$23,650 71		$23,650 71

Ledger Balances to December 31st 1893:

LEDGER D.	
Folio 439 Water Works Fund	$ 13,410 55
" 440 Real Estate	6,724 83
" 440 Dock tramway and store shed	1,882 63
" 441 Engine house chimney and wells	20,287 92
" 441 Engine foundations, boiler foundations and arches	6,777 45
" 442 Pumping machinery	59,427 72
" 442 Inlet from Saginaw River	3,218 99
" 443 Inlet from Saginaw Bay	84,778 37
" 443 Reservoir, breakwater etc. at bay	24,713 78
" 444 Iron pipe and branch castings	101,328 37
" 444 Wyckoff pipe	126,441 31
" 445 Valves for street mains	15,400 51
" 445 Public fire hydrants	14,377 54
" 446 Laying pipe	56,139 77

LEDGER D.		Brought over from page 11	$53
Folio 446	Buildings at bay		
" 447	Water meters		1
" 447	Furniture and fixtures		
" 448	Implement account	(construction)	
" 448	Engineering and general superintendence	"	
" 449	Traveling expenses	"	
" 449	Insurance expenses	"	
" 450	Interest, discount and commissions	"	
" 451	Office expenses and salaries		4
" 451	Repairs and care of hydrant, valves and pipes		1
" 452	Repairs and care of water meters		
" 452	Repairs and care of reservoir and inlet works		1
" 453	Repairs to engine house		
" 453	Repairs to dock		
" 454	Engineers and firemens wages		7
" 454	Fuel account		5
" 455	Oil, packing and engineers' supplies		
" 455	Repairs to pumping machinery		
" 456	Repairs to engine foundations		
" 456	Repairs to boiler arches		
" 457	Implement account (repairs)		
" 457	Interest account (bills payable)		
" 430	Bay City bond account ($452,000 bonds)		
" 430	Water assessment frontage on pipes		
" 432	Water rates Rolls 1872 to 1882		
" 432	" " Roll of 1883		
" 433	" " Roll of 1884		
" 433	" " Roll of 1885		
" 434	" " Roll of 1886		
" 434	" " Roll of 1887		
" 435	" " Roll of 1888		
" 435	" " Roll of 1889		
" 436	" " Roll of 1890		
" 436	" " Roll of 1891		
" 437	" " Roll of 1892		
" 437	" " Roll of 1893		
" 438	Plumbers' licenses		
" 438	Rents, Dockage etc		
" 439	Service connections etc		
			$ 791.4

Net cost of construction of works to date, $552,055 22.

Source of Supply.

From February 27th to March 7th. inclusive, a severe south westerly wind prevailed, which lowered the water in the Bay to such an extent that it was necessary to take a portion of the supply from the river, during nearly the entire time. In the nine days included in the above dates, the river valve was partially open seven and one-half days. Aside from this the river valve was open but a little more than three days during the year, of which a little more than two days was for the purpose of supplying the extra demand for fire service, principally for the W. H. Miller & Co., fire, the Eddy Avery & Eddy Mill fire and the S. McLean & Co., Mill fire.

No action has been taken during the year for the repair of the inlet works at the Bay as recommended in the last annual report. As the construction of a new inlet appears to be quite as far in the distance as ever, it is advisable that considerable work be done at the bay. All of the timber work used in the original construction of the inlet and outlet from the reservoir has become badly decayed and should be entirely removed and replaced, with masonry or earth embankment. The reservoir and inlet cut should be cleaned and deepened and the reservoir, at least, paved.

The amount paid for repairs and care of inlet works was as follows:

Salary of reservoir keeper	$ 420 00
Boat for use of reservoir keeper	10 00
Small tools for use at bay	2 12
	$ 432 12

The following table shows the dates and length of time
has been open during the year:

January	19th, Fire Service	h'r
"	20th, " "	
February	6th, Low water in bay	
"	8th, " " "	11 "
"	9th, Fire Service	
"	27th, Low water in bay	24 "
"	28th, " " " "	12 "
March	1st, " " " "	24 "
"	2nd, " " " "	24 "
"	3rd, " " " "	24 "
"	4th, " " " "	24 "
"	6th, " " " "	24 "
"	7th, " " " "	24 "
"	18th, " Fire Service,	1 "
May 26th and 27th,	" "	26 "
June	15th, Fire Service	
"	24th, " "	4 "
"	29th, Test fire apparatus	1 "
July	24th, " " "	
Sept'r	8th, Fire Service	9 "
October	6th and 7th, Low water in bay	8 "
Nov.	1st, Fire Service	
"	2nd and 3rd, Fire Service	4 "
"	15th, Low water in bay	7 "
"	17th, Fire Service	
"	26th, Low water in bay	
	TOTAL	256 H

Total for fire service..... 49 h'rs
Total for low water in bay..... 206 "

Pumping Station.

Under instructions embraced in a resoluion adopted by the board February, 28th. 1893, the superintendent prepared plans and specification for two steel boilers to be placed in the pumping station. These plans and specifications were submitted and approved by the board at their next meeting, (March, 28th.) and the superintendent instructed to invite proposals for furnishing the same. At the same meeting the superintendent was instructed to prepare plans and specifications for an addition to the boiler room, suitable for the reception of these boilers, and invite proposals for the erection of the same. The bids for the construction of the boilers and erection of the building were submitted to the board April 25th. 1893. Five bids were submitted for the boilers, and the contract was awarded to the McKinnon Manufacturing Company, they being the lowest bidders, at $1.570.00 for the two boilers with smokepipe, fire-fronts, grate, bars and all of the iron work for the arches, all necessary fittings, gauges and valves, but not including steam and feed pipes. The contract for the building and foundations for the boilers was awarded to Carney Bros., they being the lowest of seven bidders proposing to do the work at, $1.425 00. These contracts were completed satisfactorily and the two boilers have been in continuous and satisfactory operation since July, 31st. except when shut down for cleaning out. The size of the building erected was 24 ft. 5in. by 29ft. 4in.

The boilers are 16ft. long, 60 inches in diameter with 48-4 inch flues in each boiler giving heating surface of 879 64-100 square feet for each boiler.

The area of grate surface for each boiler is 22½ square feet. The entire cost of this improvement was $3.840.75 divided as follows-:

Addition to building	1.190.50
Foundation for boilers	336.00
Arches for boilers	559.58
New boilers with fronts etc complete	1.570.00
Steam Pipe, Feed Pipe and Valves	184.67
	$3.840.75

One serious break occurred to the pumping engines during the year, but fortunately, owing the prompt action of engineer Verity who was on duty at the time no serious damage resulted. About 11 o'clock in the evening of Saturday, July 22nd. while the engines were running at moder-

ate speed and under ordinary domestic pressure the strap a
end of the connecting rod of the right Gaskill engine broke v
ing. Owing to the promptness with which the steam was sh
damage was done. It was not considered safe to postpone
this break over Sunday and within an hour after the break
Dry Dock Iron Company were at work on a new strap. By r
repair being made during the night hours and on Sunday
much more than it otherwise would have been.

The lagging on the steam cylinders of the Gaskill engi
come badly burned it was all renewed during the year.

The total cost of repairs to pumping engines was:

For lagging steam cylinders Gaskill engine	
" new strap	
" work on brasses	
" bolts and plates for Quadruplex pumps	
" repairs on boilers	
" repairs on old boiler fronts	

For several years the cost of fuel for use at the pumping
been very moderate owing to the favorable contracts made
Chapin & Co. for pine slabs and edgings from their saw mill.
tracts have been made in the spring for fuel sufficient to ru
for one year. Early in the year it was found that this contra
be continued and that a considerable higher price would n
paid for the kind of fuel mentioned.

For the purpose of determining the exact relative value
refuse in use and such grades of coal as were available, the
run through the month of March with Sebewaing coal, and in
100 tons of Ohio coal were burned. The cost of the mill ref
65cts. per cord delivered in fire room. The Sebewaing coal
cost $2 50 per ton delivered in reach of the fireman. The Ohi
lump) cost $3 25 per ton delivered at the same point.

The number of gallons of water pumped with one cord
slabs and edgings averaged about 365,000, and the numbe
pumped per ton of coal was 663,000, and 725,000, for the Seb
Ohio coal respectively. On the basis of these tests it was
wood at $1 40 per cord in fire room would be no more expensi
and proposals were invited for furnishing mill refuse. But
received, from Eddy Bros & Co. at $1 00 per cord on the g

pumping station; this would make the fuel cost $1 30 in the fire room. The bid was accepted and 2058 cords have been delivered under this agreement, 1465 cords of which have been delivered in fire room and consumed.

At the commencement of the year there remained on the yard at the pumping station 933 cords of the wood received from Dolaen Chapin & Co. all of which has been delivered in the fire room and burned.

Total fuel delivered in fire room during the year:

933 cords wood @ 65cts	606 45
1465 cords wood @ $1 30	1 904 50
242 550-2000 tons coal costing	676 80
	3.187 75

Total amount paid during the year for operating pumping engines:

First engiuer's salary	1.400 00
Second engineer's salary	900 00
Two firemen each 660 00	1.320 00
Fuel	3.187 75
Oil, packing and supplies	308 72
Repairs on engines and boilers	128 28
Repairs on boiler arches	40 89
	7.285 64

And the net cost of operating the pumping engines was:

For salaries	3.620 00
" fuel consumed	3.191 65
" oil, packing and supplies used	328 64
" repairs	169 17
	7.309 46

The total number of gallons of water pumped as indicated by the revolutions of the pumping engines was 1,044,256,236 gallons; of which 1,026,282,847 gallons were pumped against a domestic pressure of 401bs per square inch at the gauge which is equivalent to a lift of 112 feet from the surface of the water in the wells, and 17,973,389 gallons were pumped against an average fire pressure of 711bs per square inch at the gauge equivalent to a lift of 184 feet from the surface of the water.

Average lift of all water pumped: 113 24-100

The cost figured on total engine house expenses $7,309 46 was:

Per million gallons pumped	$7 00
Per million gallons raised 100 feet	$6 18

The cost of fuel was:

Per million gallons pumped	$3 05
Per million gallons raised 100 feet	$2 70

The Gaskill engines were run 8,708 10-60 hours pumping gallons; the Quadruplex engines were run 54 10-60 hours, pu 410 gallons; the high pressure engine and rotary pumps were hours pumping 887,910 gallons.

The greatest quantity of water pumped in one day was lons, on the 27th day of May, the least quantity pumped in 2,259,070 gallons, on the 14th day of May.

The pumping plant consists of

BOILERS:

Five in number all horizontal return tubular boilers set brick arches.

Three boilers are 16 feet long, 66 inches in diameter with feet long and 2¾ inches interior diameter, in each boiler.

Two boilers are 16 feet long 60 inches in diameter with 48 long and 3¾ inches interior diameter in each boiler.

The area of grate surface under each boiler is as follows square feet; Nos. 2 and 3 each 34 square feet; Nos. 4 and square feet. Heating surface, No. 1, 2 and 3 each, (½ shell 1 tire tubes 1,209 51-100), 1,347 75-100 square feet: Nos. 4 and 5 e 125 66-100 entire tubes 753 98-100), 879 64-100 square feet. sure carried 65lbs.

ENGINES AND PUMPS:

One "Gaskill" horizontal compound condensing, crank a pumping engine, maximum capacity 5,000,000 gallons in 24 ho

One" Holly Quadruplex" compound, condensing, crank a pumping engine, maximum capacity 3,000,000 gallons in 24 ho

One horizontal, high pressure, piston engine, driving th two No. 10 "Holly rotary pumps, maximum capacity 2,500,00 24 hours.

Capacity of "Gaskill" pumps per revolution, 121 gallons.

Capacity of "Quadruplex" pumps per revolution, 55 gallon

Capacity of (2) Rotary pumps per revolution, 17 gallons.

WATER PUMPED 1893.

MONTH.	GASKILL ENGINES.			QUADRUPLEX ENGINES.			ROTARY PUMPS.			TOTALS.		FIRES.					
	Hours Run.	Revolutions.	Gallons Pumped.	Hours Run.	Revolutions.	Gallons Pumped.	Hours Run.	Revolutions.	Gallons Pumped.	Gallons Pumped.	Daily Average.	No. Alarms.	Hours Run.	Highest Pressure	Lowest Pressure	Average Pressure	Gallons Pumped.
January...	742.55	755,730	91.443.330	1.05	3,042	167.310				91.610.640	2.955.192	12	6.23	70	70	70	1,091.783
February .	665.10	691,253	83.641.613	6.50	17,282	950.510				84.592.123	3.021.147	10	7.39	70	70	70	1.363.428
March.....	740.15	771,908	93,400,868	3.45	8,683	477,565				93.878.433	3.028.337	9	4.44	70	70	70	797.027
April.....	713.15	625,457	75,680,297	6.45	19,092	1.050.060				76 730.357	2.557.679	10	5.09	70	70	70	759.453
May.....	734.45	637,854	77,180.334	10.25	28,818	1.584.990	1.00	5.745	97.665	78.362.989	2.543.967	14	24.17	90	70	73.7	4,940.525
June.....	719.45	770,334	93,210.414	15	675	37,125	20	2.800	47.600	93.295,139	3.109.838	12	8.48	90	70	72	1.795.808
July.....	734.30	*778,816	*89.711.457	10.40	27,258	1.499.190	3.00	11.408	193.936	91.404.583	2.948.535	14	6.54	80	70	71	1.244.371
August....	744	740,700	89,624.700							89.624.700	2.891.119	13	4.36	70	70	70	746.933
September	717.15	752,050	90,998,050	2.45	8,874	488.070	5.00	22.414	381.038	91.867.158	3.062.538	13	13.17	80	60	65.5	2.929.449
October ...	738.30	724,428	87.655.788	5.30	16,349	899.195				88.554.983	2.856.612	11	2.33	70	70	70	390.225
November.	713.50	650,003	78,650.363	6.10	16,189	890.395	2.25	9.863	167.671	79.708.429	2.656.948	11	8.03	80	70	75	1.614.721
December..	744	695,262	84.126.702							84.126.702	2.713.765	6	1.36	70	70	70	239.666
TOTALS..	8,708.10	8,593,795	1.035.323.916	54.10	146,262	8.044.410	11.45	52.230	887.910	1.044.256.236	2.860.976	135	93.59	90	60	71	17.973.389

*In July run left side of Gaskill engine alone 39½ hours making 74,798 revolutions, while making new strap.

The total quantity of water pumped each year since th
menced operations, has been as follows-:

1873	142,477,725	1883	
1874	294,714,798	1884	
1875	416,756,579	1885	
1876	518,197,129	1886	
1877	538,847,186	1887	
1878	530,197,397	1888	
1879	672,344,128	1889	
1880	827,067,372	1890	
1881	944,382,043	1891	
*1882	775,642,466	1892	
		1893	1,044,256,236

Commenced setting meters on large services in the fall of

Main Distribution.

The main distribution has been extended during the year as follows:

The 4-inch Wyckoff main pipe in the alley between Madison and Monroe street has been extended to the curb line of First street and a fire hydrant placed at the north curb line of First street at the east side of said alley.

The 6-inch Wyckoff pipe in Woodside avenue has been extended from the alley between Madison and Monroe street to Monroe street and a fire hydrant placed at the north side of Woodside avenue opposite Monroe street.

A 6-inch Wyckoff pipe has been laid in Twelfth street from Sherman street to the Tuscola road, and in the Ridge road, from the Tuscola road to Park avenue, with fire hydrants at Sheridan street, between Birney and McLellan street, at Hampton street, at Johnson street, between Johnson and Trumbull streets, at Trumbull street and at the Tuscola road.

A 6-inch Wyckoff pipe has been laid in Livingston avenue from Fourth avenue to a point opposite Eickemeyer, Kamm & Co's. planing mill with a fire hydrant opposite said planing mill.

A 6-inch cast iron pipe has been laid in Sheridan street from Center avenue to Tenth street with fire hydrants at Sixth, Eighth, Ninth and Tenth streets.

The cost of the several lines of pipe laid including valves and hydrants was as follows:

Alley between Madison and Monroe streets..... (Used old hydrant and valve taken out in 1892)	18 81
Woodside avenue..... (Used old hydrant and valve taken out in 1892)	84 36
Livingston avenue..... (Used old hydrant and valve taken out in 1892)	341 98
Twelfth street.....	2,331 66
Ridge road.....	461 32
Sheridan street.....	1,224 21
Labor on 16 inch cast iron main laid in 1892.....	142 64
	$4,604 98

Total length of pipe laid during the year:

	6-in.	4-in.
Cast Iron	1,907 feet	28 feet
Wyckoff	5,305 "	108 "
Total	7,212 "	136 "

Length of pipe in service December 31st, 1893:

	CAST IRON.	WYCKOFF.
20-inch	9,563 ft.	
16-inch	13,778 "	
12-inch	9,083 "	
10-inch	8,739 2-12 "	34,140 4-12 ft.
8-inch	2,108 5-12 "	27,038 9-12 "
6-inch	4,490 6-12 "	92,132 6-12 "
4-inch	1,124 9-12 "	21,831 4-12 "
3-inch		319 "
Total	48,886 10-12 ft.	175,461 11-12 ft. 2

Total of cast iron mains, 9 miles, 1,366 10-12 feet.

Total of Wyckoff mains, 33 miles, 1,221 11-12 feet.

Total mains, 42 miles, 2,588 9-12 feet.

VALVES.

The number of valves set in the distributing mains during

	6-in.
Flower Patent	3

Total number of valves in use:

	20-in	16-in.	12-in.	10-in.	8-in.	6-in.	4-in.	3-in.	TOTAL
Flower Patent.....	4	9	3	36	43	153	331	5	584
Galvin Patent.....			2	1	1	5	45		54
Brown Patent.....			1			1			2
Total.....	4	9	6	37	44	159	376	5	640

The following blow off gates are included in the above:

Three	6-inch
Seventeen	4-inch
Two	3-inch

FIRE HYDRANTS.

The number of fire hydrants set during the year was 14 as follows:

Matthews, with 4-inch inlet, 2 hose nozzles	11
Holly with, 4-inch inlet, 2 hose nozzles	3

Total number of fire hydrants in service December 31st 1893, 366 as follows:

Matthews, 6-inch inlet, 3 hose nozzles, gates to nozzles	32
Matthews, 4-inch inlet, 2 hose nozzles	180
Bourbon, 6-inch inlet, 3 hose nozzles, gates to nozzles	1
Holly, 4-inch inlet, 2 hose nozzles, gates to nozzles	5
Holly, 4-inch inlet, 2 hose nozzles	125
Gaskill, 4-inch inlet, 2 hose nozzles	15
Gaskill Improved, 4-inch inlet, 2 hose nozzles	1
Galvin, 4-inch inlet, 2 hose nozzles	5
Morgan, 4-inch inlet, 2 hose nozzles	1
Brown, 4-inch inlet 2 hose nozzles	1
	366

Petitions for main pipes not yet laid have been presented to the board during the year as follows:

On Third street from Birney to Johnson street.

On McLellan street from Eighth to Tenth street.

On Woodside avenue from Belinda to Trumbull street.

In addition to the lines of pipe above mentioned petitions have been presented to the board in previous years for the following described lines not yet laid:

On Campbell street from Sherman to Sheridan street.

On Sheridan street from Campbell to Woodside avenue.
On Nebobish avenue from Park avenue to Annie street.
On Third street from Trumbull street to Park avenue.
On Fourth avenue from Trumbull street to Park avenu
On Fifth avenue from Trumbull street to Park avenue.
On Jackson street from Tenth to Eleventh street.
On Lincoln avenue from Twelfth to Thirteenth street.
On Thirteenth street from Sherman to Lincoln avenue.
On Madison avenue from Thirteenth to Twenty-second
On Monroe street from Thirteenth to Sixteenth street.

The justice of the demand of the petitioners for ALL of t above described, for a supply of water for domestic use and is undisputed, but before determining the location of the p during the coming season, the attention of the board is resp to the necessity for the following described lines of pipe:

The 10-inch iron main should be connected from Sixt Twenty-third street.

The iron main in Harrison street should be extend South Center street to Forty-first street.

The old 12-inch main in Water street between Belinda street which is paralelled by the new 20-inch main on that these points should be taken up and removed to Campbell gut street and Sheridan street should each be supplied wit from Second to Center avenue; most of the residences on mentioned streets are now supplied through small pipes la cost from adjoining streets. Many of these small pipes hav eral years, and are causing a great deal of trouble and expe of leaks and breaks; the property owners should not be req them.

The 8-inch main in Michigan avenue now terminates in one at Twenty-fifth street and one at Freemont avenue; t should be connected and fire protection given to the propert borhood of the street mentioned between the above mention

The 8-inch main in Johnson street which now ends a should be extended south to a connection with the pipe laid son on Twelfth street.

A number of good residences are in course of erectio plated on Green avenue south of Center avenue which wil

with all modern conveniences and will demand an extention of the mains on that street early in the spring.

REPAIRS ON MAIN DISTRIBUTION.

The number of leaks in the main distribution found and repaired during the year was 60, all in Wyckoff mains; 9 were burst pipes caused by the bands being eaten away by corrosion; 38 were leaks in joints; 10 were knot holes, and 3 were caused by contractors or others engaged in making excavations for other improvements.

In making excavations for the sewer on Tenth street, owing to the character of the soil and the proximity of the sewer to the water main, the banks of the excavation caved in carrying the water main with it at two points between Grant and Farragut streets, and it became necessary to relay about 100 feet of this main.

The main in Twenty-fourth street was raised at a point between McCormick and Wilson streets to permit a connection to the sewer on Twenty-fourth street.

The branch pipe leading to hydrant at the corner of Twelfth and Fitzhugh street was raised to bring hydrant to proper grade in connection with the pavement on Twelfth street.

The hydrant on Fifth street between Washington avenue and Adams street was moved to the curb line.

The hydrant on the McEwan road near McEwan Bros. & Co's. mill was raised by placing an offset in the pipe connecting hydrant with the main. The hydrants at Second and Washington avenue on Eleventh street between Washington and Adams street and on Eleventh and Lincoln avenue have been raised to proper grades by substituting hydrants six inches longer than the standard length for those originally placed in these locations. The hydrant on Belinda street at the end of Belinda street bridge was broken by the Michigan Central Railroad Co. in the accidental derailment of some freight cars, the expense of replacing this hydrant was paid by the Railroad Co.

36 cast iron valve boxes have been purchased to replace wooden boxes which had become decayed or were within the limits of new pavements being constructed.

The severe weather during the months of January, February and March rendered it necessary to maintain an almost uninterrupted investigation of the condition of the fire hydrants. 47 hydrants were found

frozen, during the months mentioned, by the employees ment, and at once placed in condition for immediate use.

Two new hydrants complete of the Matthews pattern wi and 3 hose nozzles have been purchased for use on repair parts of hydrants ordered from the manufacturies and kep repairs. One of the new hydrants was used at the foot of to replace the one broken by the Michigan Central Railroa subsequently paid for by that company; the other one is in in case of another similar accident.

The head of the hydrant at the corner of Seventh and was broken through the carelessness of workmen engaged logs from cars on the Michigan Central Railroad tracks at S mill. It was necessary to procure a new head from the Ho uring Co. for this hydrant.

One 6-inch Flower valve was found with the cast iron f the discs broken, and the discs dropped down effectuall valve; this break was repaired by inserting a new frame w ing the valve body.

The total amount paid for repairs on main distribution follows:

For labor and material used in repairing 60 leaks	
" " " " relaying pipe in Tenth street	
" " " " raising pipe in Twenty-fourth street	
" " " " raising, moving and changing hydrant	
" cast iron valve boxes and setting same	
" two new hydrants complete	
" parts of hydrants for use on repairs	
" labor and local shop repairs on hydrants	
" labor examining, cleaning and thawing hydrants	
" labor cleaning wells	
" tools and repairing tools	
" labor repairing valve	
" air vent in main on Polk street	
" repairing pavements and sewers	

The following table gives date and location of each leak for the year:

DATE.			LEAKS IN MAIN PIPES, 1893.			CHARACTER.	HOW REPAIRED.
Mar.	13,	1893	4-in.	Wyckoff	Fitzhugh st., n side 13th, st. commis'ner's men put bar thro'gh pipe		Plugged.
"	16,	"	6	"	McLellan st., s side Center, Street R'y Co. cut pipe digging for pole.		Pipe & sl've.
"	31,	"	6	"	Sixth st., bet. Water and Saginaw.	Leak in j'int	Plugged.
April	10,	"	10	"	Van Buren st., bet. 11th and 12th...	Knot hole,	"
"	14,	"	10	"	Harrison street.....	Joint,	"
"	25,	"	8	"	Harrison st., bet. 34th and 35th.....	Joint,	"
May	13.	"	4	"	In alley, bet. Jackson and Van Buren, n of 10th.....	Knot hole,	"
"	27.	"	6	"	Water street at 9th.....	Burst pipe,	Pipe & sl've.
"	30.	"	6	"	13th st., bet. Monroe and Jackson ..	Joint,	Plugged.
June	3.	"	6	"	Grant St, bet 5th and Center.....	"	"
"	7.	"	4	"	Alley, bet. Adams & Jefferson at 8th	"	"
"	9.	"	8	"	Johnson st., at 8th st.....	"	"
"	21,	"	4	"	Alley, bet. Sag'w and Wash'n at 8th	"	"
"	27,	"	6	"	12th st. at Johnson st.....	Knot hole,	"
"	28.	"	8	"	Alley, Jeff'rs'n and Madis'n, 3d & 4th	Joint,	"
"	29.	"	8	"	Harrison, bet. 37th and 38th.....	Joint,	"
"	30,	"	6	"	In Water street at 9th.....	Burst pipe,	Pipe & sl've.
"	28.	"	10	"	In Bowery at 21st.....	Joint,	Plugged.
July	3.	"	8	"	18th st., bet Williams and Bowery..	Joint,	"
"	7.	"	4	"	In Farragut, bet. 6th and 8th.....	Burst pipe,	Pipe & sl've.
"	8,	"	6	"	Parker, bet. McEwan and Atlantic	Burst pipe,	"
"	10.	"	8	"	Alley, Jefferson & Madison, 2d & 3d	Joint,	Plugged.
"	11.	"	8	"	Alley, Jefferson & Madison, 2d & 3d	Burst pipe,	Pipe & sl've.
"	12.	"	8	"	In 2nd, bet. Madison and Monroe..	Joint,	Plugged.
"	13.	"	6	"	Water st. at 10th st.....	"	"
"	14.	"	6	"	Water st. at 10th st.....	"	"
"	18.	"	8	"	Alley, Jefferson & Madison, 2d & 3d	"	"
"	24.	"	8	"	Alley, Jefferson & Madison, 3d & 4th	"	"
"	25.	"	6	"	Water st., bet 9th and 10th.....	Burst pipe,	Pipe & sl've.
Aug.	1.	"	8	"	Harrison, bet. 40th and 41st.	Joint,	Plugged.
"	19,	"	6	"	Center, bet. Jackson and Van Buren	"	"
"	19.	"	4	"	9th, bet. Johnson and Trumbull....	Knot hole,	"
"	19.	"	8	"	Johnson street at 8th.....	Joint,	"
"	22.	"	6	"	Alley, Wash'ton & Adams, 3d & 4th.	Burst pipe,	Taken out.
"	23.	"	4	"	Alley, Sagin'w & Wash'ton, 3d & 4th	Burst pipe,	Pipe & sl've.
"	24.	"	10	"	Water street at 18th.....	Joint,	Plugged.
"	25.	"	10	"	Water. bet. 18th and 19th.....	"	"
"	26.	"	10	"	Water, bet. 19th and 21st.....	"	"
"	26.	"	10	"	Water. bet. 23rd and 24th.....	Knot hole,	"
"	28.	"	8	"	Harrison, bet. 36th and 37th.....	Joint,	"
"	28.	"	8	"	Harrison, at 38th	"	"
"	29.	"	8	"	River street, bet. 37th and 40th.....	Knot hole,	"
"	29.	"	6	"	Center, bet. Washington and Adams	Joint,	"
"	31.	"	10	"	South Center at Ingraham.....	Knot hole,	"
Sept.	5.	"	8	"	18th, bet. Howard and Williams....	Joint,	"
"	6.	"	6	"	Alley, Williams & Bowery at 18th..	Sleeve joint,	"
"	19.	"	4	"	Alley bet. Madison & Monroe at 10th	Sleeve joint,	"
"	28.	"	8	"	Alley, bet. Jefferson and Madison n of Center st.....	Joint,	"
Oct.	13.	"	10	"	Van Buren. bet. 12th and 13th st...	Knot hole.	"
"	28,	"	6	"	Sherman st., bet. 6th and 8th st....	Knot hole,	"
Nov.	1.	"	8	"	Alley. Jefferson & Madison. 3d & 4th	Joint,	"
"	4,	"	4	"	Alley, Madis n & Monroe, 8th & 9th	"	"
"	8.	"	6	"	Lincoln avenue at 6th st.....	Knot hole,	"
"	9.	"	10	"	Bowery. bet. 26th and 27th st.....	Joint,	"
"	10.	"	10	"	Water st.. bet. 19th and 21st st.....	Burst pipe,	Pipe & sl've.
"	14.	"	8	"	Harrison at 35th	Joint,	Plugged.
"	15.	"	8	"	Harrison, bet. 32 id and 33rd st.....	"	"
"	23.	"	6	"	Tenth street at Grant.....	"	"
Dec.	16.	"	6	"	10th st.. bet. Grant and Farragut...	"	"
"	21.	"	6	"	Water, bet. 4th and 5th.....	"	"

Burst pipe, bands rusted off.....	9
Joints.....	38
Knot holes.....	10
Caused by contractors others engaged in making excavations..	3
Total.....	60

WATER METERS.

The number of meters in service December 31st 1893 w
crease for the year of 66, the number put in being 95, an
permanently removed 29.

The use of elevator and moter indicators has been enti
as being unreliable and meters placed on the supply pip
service.

The number of meters classed as "manufacturing" at
year was 98 an increase of 8; the number classed as "dom
an increase of 59, and the number of test meters in service
of 1.

The amount paid out during the year on account of ne
setting meters was $769 46 as follows:

63 new meters including freight	
Pipe fittings for setting meters	
Lumber for boxing meters	
Labor on setting and boxing meters	
	$

The total cost to the department of the 459 meters i
$13,294 62

Value of meters, fittings etc. in stock	1
Labor etc. on 83 meters and moter indicators taken out	
Total amount charged meter account	$14

Meters set in 1893:

METERS.	3-in.	2-in.	1½-in.	1-in.	¾-in.	⅝-in	½-i
Union Rotary	1	1	1	1		2	
Union Duplex						2	
Crown				2	1		1
Empire					3		4
Gem		1					
Worthington		2				5	
Hersey						5	
Thomson				2	1	6	
Thomson Bee						6	24
Total	1	4	1	5	5	26	29

Meters taken out in 1893:

	4-in.	3-in.	2-in.	1-in.	¾-in.	⅝-in.	½-in.	TOTAL
Union Rotary	1	1	1			2		5
Union Duplex						1		1
Crown					1		1	2
Empire				1	2		5	8
Worthington						1		1
Hersey						8		8
Thomson						4		4
Total	1	1	1	1	3	16	6	29

Meters in service December 31st, 1893:

	8-in.	4-in.	3-in.	2-in.	1½-in	1-in.	¾-in.	⅝-in.	½-in.	⅜-in.	TOTAL.
Union Rotary	1	4	20	6	4	3	1	30			69
Union Duplex								20			20
Crown					1	22	33		27	38	121
Empire						5	33		20		58
Gem				1							1
Worthington				7	6			14			27
Hersey						2	5	22			29
Thomson						2	2	100			104
Thomson Bee								6	24		30
Total	1	4	20	14	11	34	74	192	71	38	459

Meters in stock December 31st, 1893:

	4-in.	3-in.	1-in.	¾-in.	⅝-in.	½-in
Union Rotary	2	1			2	
Union Duplex					2	
Crown			3	1		1
Empire			1	2		5
Worthington					2	
Hersey					4	
Thomson					2	
Total	2	1	4	3	12	6

SUPPLY THROUGH METERS.

The quantity of water supplied through meters during
110,096,016 gallons; an increase of 1,379,116, gallons over th

The total amount charged on the roll of 1893 for
through meters was $11,067 14, being a small fraction more
thousand gallons.

This excess over the maximum charge per thousand
counted for by the large number of meters through which t
water used was less than the minimum quantities for w
made. The quantity of water supplied through meters for
purposes was 61,676,139 gallons, a decrease of 5,776,743 gall

The amount charged on the roll of 1893 for water su
meters for manufacturing purposes was $5,540 97 an averag
less than 9cts per thousand gallons.

The quantity of water supplied through meters for dom
was 48,419,877 gallons, an increase of 7,155,859 gallons.
charged on roll of 1893 for water supplied for domestic pu
526 17 an average of about 11 4-10 cents per thousand gallon

It will be seen from the above that more than 45 per c
ceipts of the department for water were derived from about
of the total quantity of water pumped. If the very liberal
per cent of all water pumped be made for slip of pumps, una
age, and city uses it would leave the quantity of water deli
services about 730,000,000 gallons, and the 45 per cent of th

rived from water supplied through meters would still represent but about 15 per cent of the quantity of water supplied to consumers. Can there be any question that the result of a more general application of meters must result in either a large increase in the revenue or a material decrease in the quantity of water delivered.

REPAIRS ON METERS.

The number of meters found broken and taken out for repairs was 58 of which 3 were sent to the factory for repairs and 55 were repaired by the inspector with parts ordered from the manufactories. 115 meters not broken were found not registering properly, and taken apart, cleaned and replaced. Of the broken meters, 2 were frozen, 2 rubber pistons ruined by hot water, and 6 rubber pistons so badly worn as to require new pistons.

The other repairs consisted principally of new pinions and wheels in the registering gear.

The total amount paid for repairs and care of meters was $574 56, as follows:

Monthly inspection and reading	$271 25
Repairs on 3 meters sent to shop and freight	13 62
Labor on repairing meters and meter boxes	112 00
Material and parts of meters bought for repairs	51 71
Labor cleaning meters	87 75
Labor changing, taking out and replacing meters	29 75
Tools and repairing tools	8 48
	$574 56

SERVICE CONNECTIONS.

The number of new service connections made with main pipes during the year was 99 of which 97 were made with corporation stops and 2 were branch connections.

The number of service connections taken out was 5; leaving whole number of service connections with main pipes December 31st 1893, 1,912.

The number of new service connections made with private pipes was 5.

Service connections put in 1893:

	BRANCHES.		CORPORATIONS.			
	3-in.	2-in.	1-in.	¾-in.	⅝-in.	½-
In Cast Iron main pipes ...			1	1	1	
In Wyckoff main pipes....	1	1	8	7	31	3
Total.....	1	1	9	8	32	4

The 3-inch and 2-inch branch connections were ma
branches bushed to the sizes mentioned at the opening fro

The connections taken out were:

	1-inch	¾-i
From Cast Iron mains.....	1	
From Wyckoff mains.....		
Total.....	1	

Service connections in main pipes December 31st 1893:

	BRANCHES.					CORPORATIONS.				
	8-in.	6-in.	4-in.	3-in.	2-in.	2-in.	1¼-in	1-in.	¾-in.	⅝-in.
Iron m'ns		2	13		4	2	5	50	59	38
Wyckoff.	1	3	14	2	2	8		439	197	400
Total..	1	5	27	2	6	10	5	489	256	438

Of these connections 119 have been abandoned, and are
main pipe leaving 1793 with services connected.

The number of separate services supplied through th
tions is 1978.

The amount paid out during the year for new service connections was 23 58 as follows.

104 new service connections	$58 48
Labor putting in service connections	59 75
Rethreading old taps	1 75
Tools	3 60
	$123 58

The amount received for service connection permits was $343 40.

SERVICES.

The number of services shut off by employees of this department dur- g the year was 334; of which 71 were shut off at the request of consumer, 7 were premises found vacant, 23 shut off on account of service being und leaking, and 113 for non-payment of water rates. The number of rvices opened by this department during the year was 282.

The whole number of services in the city open December 31st 1893 was 48; and the number shut off 530. Of the services shut off 18 have been rtially put in but are not yet completed, 69 supply vacant dwellings or siness places, 104 supply premises from which the buildings have been rned or removed, 28 represent a portion of the supply only on the pro- rty to which they were introduced the same premises being provided ith other services from which their supply is taken, 149 supply services hich have been shut off at the request of consumer but on which no rates e delinquent, 11 are closed on account of no water being used on the emises during the winter months, 2 are closed for breaks in the service pes not yet repaired, and 149 are closed by reason of the rates not being id; some of these last mentioned have been shut off some years.

The total amount paid out during the year on account of the repair id care of service pipes not including the meters is $346 13 as follows:

Labor examining services and turning on and off	$292 25
Labor taking out, repairing and closing service connections	23 50
Labor repairing four 2-in private main and one 4-in service	12 25
Material for these repairs	10 18
Labor on leaks in services between main pipe and curb	7 95
	$346 13

Appended to this report is the usual summary of statistics for the ear.

All of which is respectfully submitted.

E. L. DUNBAR,
Secretary and Superintendent.

Summary of Statistics.

REPORT FOR 1893.

Water Works of Bay City, Bay County, Michigan.
Built in 1872.
Owned by the City.
Source of supply, Saginaw Bay, an arm of Lake Huron.
Mode of supply, direct pumping.

PUMPING.

1. Builders of pumping machinery, Holly Manufacturing Com
2. Kind of fuel, pine slabs and edgings and coal.
3. Fuel consumed, 2404 cords slabs and edgings, cost $2,51
   550-2000 tons soft coal, cost $676 80; total $3,191 65.
6. Total water water pumped in gallons,1,044,256,236 gallons.
8. Average dynamic head 113 24-100 feet.
   Cost of pumping based on pumping station expenses $7,309 4
11. Per million gallons pumped, $6 15.
12. Per million gallons raised one foot, $0 0618.
    Cost of pumping based on total maintenance including inte
    by city. $41,520 06
13. Per million gallons pumped, $39 77.
14. Per million gallons raised one foot, $0,351.

CONSUMPTION.

1. Estimated population to date, 33,000.
2. Estimated population on pipe lines, 19,500.
3. Estimated population supplied, 13,500.
4. Total gallons supplied, 1,044,256,236.
5. Passed through domestic meters, 48,419,877 gallons—4 6-10 per
6. Passed through manufacturing meters, 61,676,139 gallons—5 9-1
7. Average daily consumption, 2,860,976 gallons.

8. Gallons per day to each inhabitant, 86⅔.
9. Gallons per day to each consumer, 212.
10. Gallons per day to each service (distribution 22), 1596.

DISTRIBUTION.

MAINS.

1. Material, cast iron and Wyckoff patent.
2. Size 3 inch to 20 inch.
3. Extended 7,348 feet.
5. Total in use, 42½ miles.
6. Cost of repairs per mile $18 98.
7. Leaks per mile, 1½.
8. Small distribution less than 4 inches, 319 feet.
9. Hydrants added, 14.
10. Number of hydrants in use, 366.
11. Stop gates added, 19.
12. Number in use, 630.
13. Number of small gates less than 4 inches, 5.
14. Number of blow off gates, 21.
15. Ranges of pressure at center day and night, 35 to 38 pounds.

SERVICES.

16. Material, lead wrought iron and Wyckoff patent.
17. Sizes, ¾ inch to 8 inch.
21. Service taps added, 76.
22. Number in use, 1,793.
25. Meters added, 66.
26. Number in use, 459.
27. Moters and elevators added, 7.
28. Number in use, 63.

Financial.

RECEIPTS.—DIVISON 1.

A	Water rates, domestic	$17,615 69
B	Water rates, manufacturing	5,780 10
C	Net receipts from water rates	
D	Miscellaneous, service connections etc.	
E	Total	
	From Public Funds:	
J	Tax levy for interest	

DIVISION II.

	From Fixed Rates:	
L	Domestic	$12,206 77
M	Manufacturing	388 07
N	Total	
	From Meter Rates:	
O	Domestic	5,408 92
P	Manufacturing	5,392 03
Q	Total	

EXPENDITURES.

AA	Management and repairs	12,610 06
BB	Interest paid by city	28,910 00
CC	Total maintenance for year	
DD	Balance to construction	

CONSTRUCTION.

R	Balance from previous years	11,408 26	
	Balance from maintenance	11,217 48	
	Total	22,625 74	
FF	Extention of mains		4,604 98
HH	Water meters		769 46
	Engine house		1,190 50
	Boilers and arches		2,650 25
II	Total for construction		9,215 19
JJ	Balance		13,410 55
	Total		22,625 74

USES SUPPLIED AT FIXED RATES, JANUARY

1 Ashery.
4 Bakeries.
1 Bank.
5 Barber shops.
2 Bath rooms (public).
1 Bath room (Turkish).
205 Baths (private).
5 Blacksmith shops.
6 Boarding houses.
6 Boilers (for power).
8 Bottling works.
1 Broom factory.
19 Business blocks.
1 Business College.
6 Butcher shops.
1 Canning works.
2 Carriage shops.
1 Cemetery.
3 Churches.
1 Cigar factory.
2 Clothes cleaning.
1 Dairy.
652 Dwellings.
1 Express office.
81 Families in blocks.
3 Fire pipes.
3 Fountains.
1 Gas engine.
1 Gas works.
6 Halls (public).
4 Harness shops
385 Hose for sprinkling.
21 Hotels.
1 Laboratory.
2 Laundries.
1 Machine shop.
1 Mattrass factory
23 Offices.
1 Paint shop.
1 Passenger depot
1 Pawn shop.
3 Photograph gal
3 Plumbing shops
1 Printing office.
2 Refrigerators.
8 Restaurants.
48 Saloons.
13 Schools.
1 Skating rink.
2 Shoe shops.
6 Stables (hotel).
6 Stables (livery).
7 Stables (mill).
104 Stables (private
1 Stone yard.
83 Stores.
2 Tailor shops.
1 Telegraph office
1 Undertakers roo
715 Water closets a
60 Water closets i
7 Water moters.
2 Ware houses.

USES SUPPLIED THROUGH METERS, JANUARY 1st, 1893.

3 Bakeries.
4 Banks.
191 Baths (private).
1 Bath room (public).
1 Barbor shop.
1 Bicycle factory.
3 Boarding houses.
37 Boilers (for power).
2 Boiler shops.
3 Bottling works.
6 Box factories.
1 Brewery.
19 Business blocks.
1 Business college.
3 Butcher shops.
1 Canning works.
1 Carpet cleaning.
1 Cemetery.
1 Chapel.
5 Churches.
2 Club rooms.
1 Coal and wood yard.
1 Cooper shop.
1 County jail.
1 County court house.
1 Cracker factory.
1 Cross arm factory.
1 Crystal water works.
4 Drill houses.
269 Dwellings.
1 Electric light station.
4 Elevators.
21 Fire pipes.
2 Flouring mills.
4 Foundries.
3 Gas engines.
1 Government building.
3 Green houses.
11 Halls (public).
225 Hose for sprinkling.
15 Hotels.
2 Laundries.
1 Locomotive stand pipe.
1 Locomotive round house.
9 Machine shops.
1 Masonic temple.
26 Offices.
1 Opera house.
2 Passenger depots.
1 Photograph gallery.
1 Pipe factory.
11 Planing mills.
1 Plow factory.
2 Printing offices.
1 Reel factory.
2 Restaurants.
1 Rink.
9 Saloons.
8 Salt blocks.
10 Saw mills.
2 Sash and door factories.
1 School.
2 Shingle mills.
1 Stable (buss and hack).
2 Stables (hotel).
6 Stables (mill).
7 Stables (livery
60 Stables (private).
1 Stable (street-car).
40 Stores.
657 Water closets and urinals.
52 Water moters
2 Ware houses.
1 Wooden ware works.

Material Used in Running Pumping Engi
1893.

2,404 cords wood	cost	$2,514 85
242 550-2000 tons coal	"	676 80
245 gallons cylinder oil	"	
50 pounds lubricant	"	
2 gallons of lard oil	"	
5 pounds plumbago	"	
5½ lbs. cotton packing	"	
9¼ lbs. hemp	"	
4⅝ lbs. Garloch	"	
1¾ lbs. Heston	"	
13 lbs. Eureka	"	
12 lbs. sheet rubber	"	
26 lbs. 1in. sqr. rubber packing	"	
3½ lbs. boiler gaskets	"	
2 lbs. wicking	"	
578 lbs wipers	"	
16 cans metal polish	"	
½ lb. oxolic acid 20c 30 boxes concent'd lye 2 62.	"	
13 brooms $3.25, 94½ lbs. soap $4.72	"	
Emery cloth	"	
490 gallons kerosene oil	"	
73 boxes matches 85c. one doz wicks 11c	"	
6 doz. lamp chimneys 3 70. Lantern globes 20c...	"	
16 lbs valve rivets 1 44. 14 lbs valve leather 4 06..	"	
Hose, oil cans, sheet copper and tools	"	
Ice for season	"	
Diary and rent of telephone	"	

CITY USES FOR WHICH NO PAYMENT IS MADE

1 City building occupied by police station and city officers.
1 City building occupied by public library and water office.
5 Steamer, hose and truck houses, 17 horses, 2 steamers, 1 chemi
15 Water closets in city buildings.
1 Electric light station.
11 Public watering troughs.
3 Ornamental fountains in public squares.
10 Hose for sprinkling parks.
366 Public fire hydrants.

TWENTY-THIRD

ANNUAL REPORT

OF THE

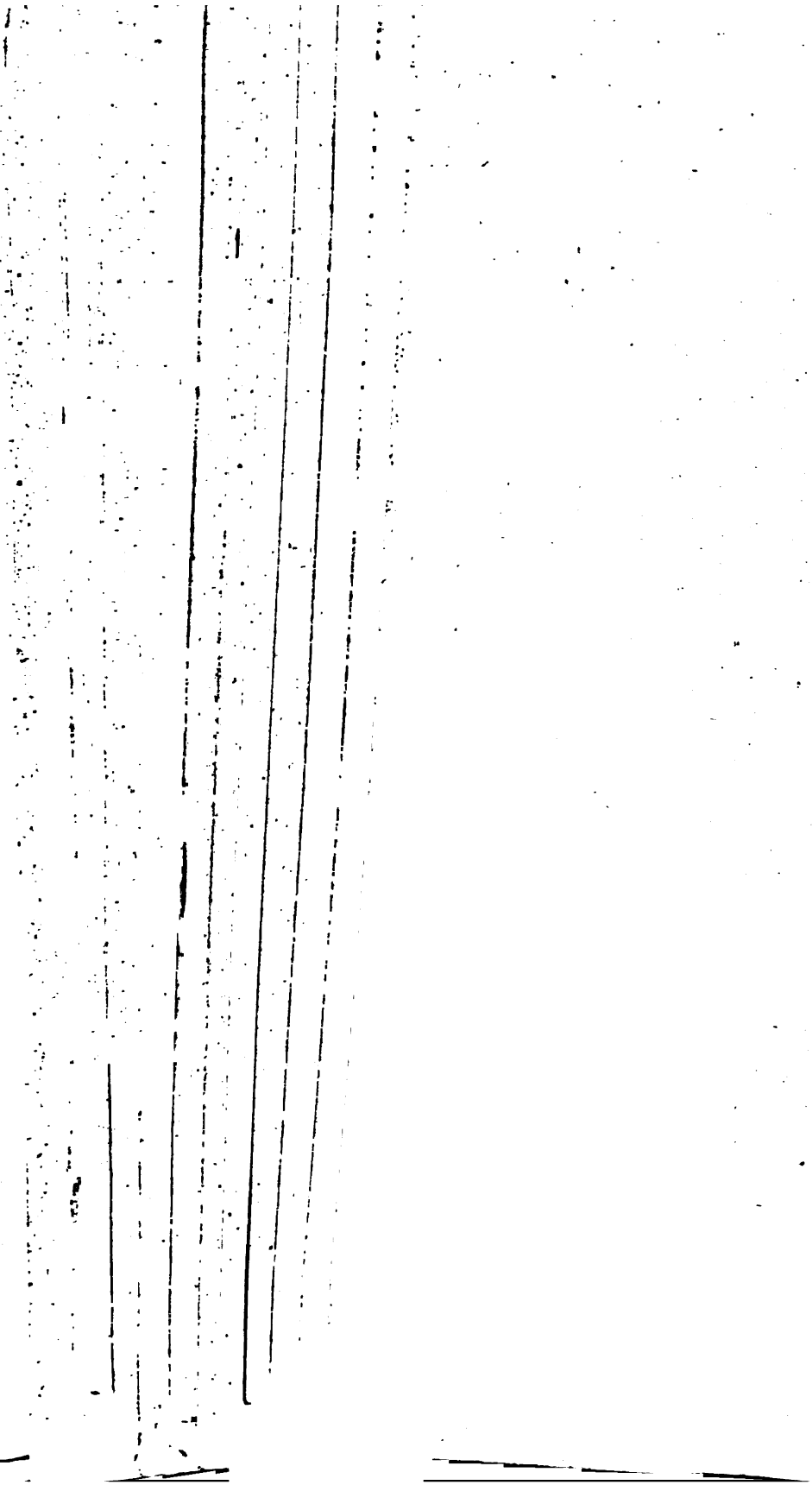
WATER DEPARTMENT

—OF—

BAY CITY, MICHIGAN.

DECEMBER 31,
1894.

J. P. Lambert,
Book & Job Printer,
Bay City, Mich.



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WATER DEPARTMENT

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BAY CITY, MICHIGAN.

DECEMBER 31,
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J. P. Lambert,
Book & Job Printer,
Bay City, Mich.

Water Departmen

1895.

Commissioners.

ANDREW WALTON, PRESIDENT.
(Term Expires Sept. 6th, 1901.)

G. HENRY SHEARER.
(Term expires Sept. 6th, 1895.)

BENJAMIM F. RAY,
(Term expires Sept. 6th, 1896.)

SANFORD V. WILKIN.
(Term expires Sept. 6th, 1897.)

LOUIS MORITZ,
(Term expires Sept. 6th, 1898.)

DUNCAN McGREGOR,
(Term expires Sept. 6th, 1899.)

FREMONT J. TROMBLE,
(Term expires Sept. 6th, 1900.)

Officers and Employees.

Supt. & Sec'y.....E. L. DUN
Office Assistant.....T. A. DELZE
Inspector.....F. H. COLLI
Reservoir Keeper.....L. D. CARPE
First Engineer.....A. B. VERIT
Second Engineer.....J. E. DARLIN
Firemen.....JAS. H. MCG
PATRICK O'H
Foreman on Repairs.....THOMAS LARI

Superintendent's Report.

To the Honorable Board of Commissioners of Water Works:

Gentlemen:—I have the honor to submit the following report of the operations of the water department for the year ending December 31st, 1894.

The receipts of the department were $272.82 less than for the year 1893; the receipts from water rates being $574.96 less, and the receipts from miscellaneous sources $302.14 more. The decrease in amount received from water rates is due to the depression in manufacturing interests and the consequent partial closing down of many of the industries of the city. The increase in receipts from miscellaneous sources is caused by the furnishing and laying of several hundred feet of pipe for private individuals, the expense of which was first paid by this department and afterwards repaid by the consumers.

The quantity of water pumped during the year was 19,520,615 gallons less than for the year 1893. Of this decrease more than 9,000,000 gallons was in water supplied through meters for manufacturing purposes. While the number of manufacturing meters is the same as reported on the 31st day of December, 1893, to-wit: 98, there has been no water used during the year through 8 of these meters, and a number of others show a material decrease in the quantity of water used through them.

The most important work of the year was the commencement of the improvement of the inlet works at the bay.

At the June session of the board, certain repairs to these works were reported as being absolutely necessary to be done as soon as practicable; particularly the removal of the timber dam forming a portion of the effluent chamber of the inlet basin, and the entire reconstruction of this chamber. As this work would render it necessary to empty the basin it was recommended that the cleaning, deepening and paving of the basin be done at the same time. The work was not commenced till late in September, but from that time

until early in November when the inclemency of the w
stop to further advantageous prosecution of the work.
were employed as could be used to advantage. The
plished consisted of the entire reconstruction of the effl
of the inlet basin, and the removal of about 3,000 cubic
iment and clay from the basin. There remains abou
yards of material to be removed from the basin.
chamber is to be rebuilt, and the slopes of the banks are

At the pumping station a substantial frame coal h
erected, of sufficient capacity to store 200 tons of coal.

The cost of operating the works for the year, in
tenance and repairs was $16,977.98, an increase of $4,3
year 1893. This increase is due mainly to the expend
than $4,000.00 in the improvement of the inlet works at
has all been charged to repairs, although a considerable
might properly be classed as construction. There ha
small increase in the cost of fuel, due to experimentin
grades of coal, and loss from exposure of fuel before the
the coal house.

FINANCIAL.

RECEIPTS.

The receipts of the department for the year were $23,554.72 from the following sources:

Water rates roll of 1891	$ 12 70	
Water rates roll of 1892	40 25	
Water rates roll of 1893	285 43	
*Water rates roll of 1894	22,482 45	
Total from water rates		$22,820 83
Plumbers' licenses	$ 40 00	
Repairs on services	11 20	
Repairs on main dirtribution	18 33	
Rent of boom	75 00	
Service connections	215 24	
Sale of cast iron pipe	182 88	
Sale of valves and valve boxes	20 50	
Sale of fire hydrants	50 00	
Laying pipe for consumers	120 74	
Total from miscellaneous		733 89
		$23,554 72

The amounts collected have been deposited with the City Treasurer each month as per receipts on file as follows:

January 31st,	1894	$ 1,126 15
February 28th,	"	446 99
March 31st,	"	1,333 04
April 30th,	"	1,674 15
May 31st,	"	930 48
June 30th,	"	1,377 35
July 31st,	"	1,949 55
August 31st,	"	1,503 19
*September 29th,	"	1,881 52
October 31st,	"	2,715 77
November 30th,	"	1,327 32
December 31st,	"	7,289 21
		$23,554 72

*Does not include $1.25 returned to consumer in September.

The total amount charged on the roll of 1894 wa
follows:

For water supplied at fixed rates	$12
For water supplied at meter rates	11
For water supplied for building purposes	
	$23

The amounts collected on roll of 1894 were:

From fixed rates	$11
From metered water	10
From building purposes	
	$22

The amounts uncollected were:

From fixed rates	$
From metered water	
From building purposes	
	$

The amounts collected during the year from previo
were:

From fixed rates	$
From metered water	
From building purposes	
	$

EXPENDITURES.

Expenditures of the department in the year were $21,027.14, as follows:

For maintenance accounts:

Supt. and Secy's salary	$ 1,800 00	
Office assistant	800 00	
Office expenses	409 16	
Repairs on main distribution	670 56	
Repairs on services and turning on and off	391 54	
Repairs and care of water meters	660 33	
Repairs and care of inlet works	4,509 76	
Service connections	60 07	
Salaries of engineers and firemen	3,620 00	
Fuel	3,557 53	
Oil, packing and engineer's supplies	281 68	
Repairs on engines and boilers	158 48	
Repairs on boiler arches	3 00	
Repairs to engine house	55 87	
Total for maintenance accounts		$16,977 98

For construction accounts:

Coal house	$ 1,113 50	
Water meters and setting	674 49	
Cast iron pipe	1,447 70	
Valves	155 66	
Fire hydrants	140 75	
Laying pipe	517 06	
Total for construction accounts		4,049 16
		$21,027 14

The total cost of maintenance and repairs from the construction of the works to the present date is $242,849.60, not including the interest on the bonded debt, and the cost of construction to date is $555,702.16

Account With Water Works Fund And City Treasurer.

The balance in the water works fund January 1st, 1894, was	$ 13,410 55	
Amount of collections deposited with City Treasurer for account of Water Works fund	23,554 72	
Amounts withdrawn from Water Works fund on Recorders warrants No 299 to 310 inclusive		$21,027 14
Balance in Water Works fund December 31st, 1894		15,938 13
	$36,965 27	$36,965 27

There has been deposited with the City Treasurer t
the Board of Water Works:

January 31st,	1894—Warrant	No.	299	$
February 28th,	"	"	300	
March 31st,	"	"	301	
April 28th,	"	"	302	
May 31st,	"	"	303	
June 30th,	"	"	304	
July 31st,	"	"	305	
August 30th,	"	"	306	
September 28th,	"	"	307	
October 31st,	"	"	308	
November 30th,	"	"	309	
December 31st,	"	"	310	

The City Treasurer has paid for account of Board of Water Works, orders of the Secretary Nos. 2143 to 2670 inclusive .....

The following table shows the amounts collected, a
lected, and the total amount charged on each year's
works commenced operations.

YEARS.	Collected.	Uncollect
1873—January 1st to April 30th	$728 82	
1873-4 May 1st, 1873, to April 30th, 1874	5,440 80	$1
1874-5 May 1st, 1874 to April 30th, 1875	6,908 16	44
1875—May 1st to December 31st	7,269 55	28
1876	9,571 26	82
1877	9,604 26	134
1878	10,078 15	324
1879	11 708 97	136
1880	13,155 74	120
1881	15,002 61	212
1882	17,352 47	158
1883	18,713 46	98
1884	18,892 02	132
1885	19,716 73	270
1886	19,348 61	126
1887	19,435 25	88
1888	21,266 45	132
1889	22,118 45	115
1890	23,282 74	217
1891	24,616 31	293
1892	24,161 98	305
1893	23,559 26	600
1894	22,482 45	883
Totals	$354,414 50	$4,509

BALANCE OF ACCOUNTS FOR 1894.

LEDGER E.

Folio 63.	City Water Works Fund	$ 2,527 58		
" 65.	Office Dept. Salaries	2,600 00		
" 76.	Office Dept. Expenses	409 16		
" 77.	Street and Service Dept. repairs on main distribution	652 23		
" 68.	" " " repairs on services, etc	380 34		
" 69.	" " " repairs and care of meters	660 33		
" 72.	" " " repairs and care of inlet works	4,509 76		
" 72.	Pumping Dept. Salaries	3,620 00		
" 73.	" " fuel	3,557 53		
" 74.	" " oil, packing and supplies	281 68		
" 75.	" " repairs to engines and boilers	158 48		
76.	" " repairs to boiler arches	3 00		
" 77.	Repairs to engine house	55 87		
" 78.	Water meters, new meters and fittings	634 14		
" 79.	" " setting meters	36 97		
" 80.	Main distribution, cast iron pipe	1,250 10		
" 81.	" " valves	125 16		
" 81.	" " fire hydrants	90 75		
" 82.	" " laying pipe	396 32		
" 83.	Engine house, coal house	1,113 50		
" 60.	Water rates Roll of 1891			12 70
" 60.	" " Roll of 1892			40 25
" 59.	" " Roll of 1893			285 43
" 58.	" " Roll of 1894			22,482 45
" 61.	Plumbers' license			40 00
" 61.	Rents, dockage, etc			75 00
" 71.	Service connections			127 07
		$23,062 90		$23,062 90

Ledger Balances from January 1st, 1872, to December 31st, 1894:

LEDGER E.

Folio 2.	Construction, Real Estate	$ 6,724 83	
" 2.	" Dock Tramway, etc	1,882 63	
" 3.	" Engine house chimney, etc	21,401 42	
" 3.	" Engine found., boiler found., etc	6,777 45	
" 4.	" Pumping machinery	59,427 72	
" 4.	" Inlet from Saginaw River	3,218 99	
" 5.	" Inlet from Saginaw Bay	84,778 37	
" 5.	" Reservoir, breakwater, etc	24,713 78	
" 6.	" Cast iron pipe	102,578 47	
" 6.	" Wyckoff patent pipe	126,441 31	
" 7.	" Valves for street mains	15,525 67	
" 7.	" Fire hydrants	14,468 29	
" 8.	" Laying pipe	56,536 09	
" 8.	" Buildings at bay	452 46	

Folio	9,	Construction	Water meters	15,
"	9,	"	Furniture and fixtures	
"	10,	"	Implements	1,
"	10,	"	Engineering and general superintendence	7,
"	11,	"	Travelling expenses	
"	11,	"	Insurance	
"	12,	"	Interest, discount and commissions	4,
"	13,	Maintenance,	Office expenses and salaries	51,
"	13,	"	Repairs and care of hydrants, valves and pipes	15,
"	14,	"	Repairs and care of water meters	3,
"	14,	"	Repairs and care of inlet works	15,
"	15,	"	Repairs to engine house	1,
"	15,	"	Repairs to dock	
"	16,	"	Engineers and firemens wages	77,
"	16,	"	Fuel	58,
"	17,	"	Oil, packing and supplies	8,
"	17,	"	Repairs to pumping machinery	6,
"	18,	"	Repairs to engine foundations	
"	18,	"	Repairs to boiler arches	1,
"	19,	"	Implements	1,
"	19,	"	Interest on bills payable	3,
"	20,	City Water Works fund		15,
"	1,	Bay City Bond account ($452,000)		
"	1,	Water assessment frontage on pipe		
"	21,	Service taps and service boxes		
"	21,	Rents, dockage, etc		
"	22,	Plumbers' licenses		
"	24,	Wates rates		
				$814,

The City Treasurer has paid during the year from n
by tax levy $20,000.00 of the principal of bonds issued for
construction, making total amount of said bonds
$90,000.00, and amount outstanding $362,000.00 issued
follows:

Water Works Bonds Outstanding.

SERIES.	DATE OF ISSUE.	PAYABLE.	AMOUNT.	INTEREST.
No. 9	January 15, 1872	October 15, 1895	$10,000 00	8 per cent.
" 10	" " "	" " 1896	10,000 00	"
" 11	" " "	" " 1897	10,000 00	"
" 12	" " "	" " 1898	8,000 00	"
" 13	August " "	Febru'y 16, 1899	10,000 00	"
" 14	" " "	" " 1900	10,000 00	"
" 15	" " "	" " 1901	10,000 00	"
" 16	" " "	" " 1902	10,000 00	"
" 17	" " "	" " 1903	10,000 00	"
" 18	" " "	" " 1904	9,000 00	"
" 19	" " 1873	" " 1905	10,000 00	"
" 20	" " "	" " 1906	10,000 00	"
" 21	" " "	" " 1907	10,000 00	"
" 22	" " "	" " 1908	10,000 00	"
" 23	" " "	" " 1909	10 000 00	"
" 24	Febr'y 15, 1874	" " 1910	10 000 00	"
" 25	April 15, "	April 15, 1911	10,000 00	"
" 26	" " "	" " 1912	10,000 00	"
" 27	" " "	" " 1913	20,000 00	"
" 29	October 15, "	October 15, 1895	10,000 00	"
" 30	" " "	" " 1896	10,000 00	"
" 31	" " "	" " 1897	10,000 00	"
" 32	" " "	" " 1898	10,000 00	"
" 33	March 1st, 1875	March 1st, 1900	10,000 00	"
" 34	" " "	" " 1901	10,000 00	"
" 35	June 1st, "	June 1st, 1902	10,000 00	"
" 36	" " "	" " 1903	10,000 00	"
" 37	" " "	" " 1904	10,000 00	"
NOT SERIED.				
No's 1 to 25	May 1st, 1891	May 1st, 1906	25,000 00	5 per cent.
" 26 to 50	" " "	" " 1911	25,000 00	"
" 51 to 63	" " "	" " 1917	12,500 00	"
" 64 to 76	" " "	" " 1918	12,500 00	"
			$362,009 00	

Interest paid by the City Treasurer during the year, $28,510.00. Total interest paid on Water Works bonds to December 31st, 1894, $632,765.00.

Source of Supply.

The supply from the river has been used a total o
hours and 55 minutes. Ten and a half days of this time
was drawn entirely from the river, while making a conn
the inlet pipe from the bay, between the inlet basin and
be used while the repairs were being made in the basin
reconnecting the inlet pipe with the effluent chamber.
of the time the river supply was in use only a small po
supply was drawn from that source, the supply from th
nearly equal to the demands upon the works.

It became evident, early in the summer, that the con
the large log boom east of the mouth of the river had
effective barrier to the contaminaiion of the present sourc
from the river discharge; the water clearing up much
usual after the spring freshets, and not being afterward d
the water from the river as has been the cause heretofore
summer after a few days of westerly winds. As soon
seemed established that no particular advantage so far as
of the supply was concerned, could accrue from the rem
source of supply to the west shore of the bay, the surveys
for the permanent improvement of the inlet works were

Before commencing work in the basin it was necessa
a connection with the inlet pipe between the inlet bas
shore, and cut off the connection between the pipe and
chamber of basin in order to supply the city from the ope
side of the basin, and avoid using river water during the
the work in the basin wae being done. The material be
ground, the work was commenced on the 21st day of Sept
as soon as the preliminary work of making connection wit
pipe, and lowering the water in the basin was completed, a
was employed removing the old effluent chamber, and taki
sediment and clay wash that twenty years of service had d

the basin. The mason work on the new effluent chamber was commenced on the 16th day of October, and as many masons and stone cutters employed as could work to advantage. This section of the work was completed, and coping placed on the 14th day of November. Before this was completed the inclemency of the weather had put a stop to the work in the basin, and it had been permitted to fill with water.

The total amount expended on these repairs and improvements was $4,059.76 as follows:

Connection with inlet pipe outside of basin	$ 209 60
Removing old effluent chamber and excavating for new chamber	165 25
New effluent chamber, labor and material	1,526 59
Repairs on gate and pipe for effluent chamber	71 23
Timber, nails, &c., for runways and tool house	96 91
Cobble stone to be used in paving	55 00
Labor pumping water and cleaning basin	1,795 17
Tools	140 01
	$4,059 76

The total amount expended during the year on the repair and care of inlet works was $4,509.76 as follows:

Repairs and improvements at bay	$4,059 76
Salary of reservoir keeper	420 00
Dredging in front of river inlet	30 00
	$4,509 76

The estimated cost of completing the improvements to the inlet basin, including the reconstruction of the influent pipe is $4,000.00

It is recommended that the inlet cut as far out as the end of the breakwater be improved in the same manner as the inlet basin.

Pumping Station.

It having become evident that pine slabs and edg
longer be depended upon for the entire supply of fuel. i
before the close of 1893 to erect a coal house in the rear
room. Plans and specifications were prepared, and pr
for its erection. Ten proposals were received and ope
mittee of the board on the 30th day of January, 1894.
was awarded to Eickemeyer, Kamm & Co., for the su
they being the lowest bidders.

In making the excavation for the foundation piers
necessary to make some changes in the sewer from the
to the river: these changes were made at a cost of $13.5
cost of coal house $1,113.50.

It is a substantial frame structure, 20 feet by
ground, supported on stone masonry piers, has steel roo
iron coal shutes conveniently arranged for unloading
wagons. It has an easy storage capacity for 200 tons o
is a driveway through the center to permit the deliveri
front of the boilers by teams if required, and it is conn
boiler room by an enclosed passage.

There has been no serious breakage in any of the p
during the year. The right pillow block of the Gaski
oped indications of weakness in the summer, and it wa
a cast steel brace in the same manner as the left pil
strengthened in 1893. No other repairs have been re
of the engines except such as could be done by the engi
and all of the engines are in good condition.

A policy of insurance for $12,500.00 on the five boi
was taken out with the Hartford Steam Boiler Inspecti
ance Co. early in the year.

The two boilers put in in 1893 are doing good servi
first class condition. The three old boilers are in good
the insurance company at their last inspection reduce

to be carried on them to 65 lbs, and recommended that action be taken toward their replacement with new boilers; this recommendation is made only on account of their age they having been in service 22 years.

While those boilers appear to be perfectly sound and stood the test by water pressure of 120 lbs. to the square inch without any indication of weakness, there is no doubt for absolute safety, and to insure the ability to run all of the pumping engines to the full limit of their capacity, both as to quantity and pressure, it will be advisable to carry out the recommendations of the insurance company, and replace the old boilers one at a time until all are renewed. Before any action is taken in the matter, it will be advisable to examine into the merits of water tube boilers with a view to substituting them for the tubular boilers now in use.

The repairs on the boilers during the year consisted of one new flue placed in No. 3 boiler, new gauge cocks, and gauge glass frame, and 395 lbs. of grate bars.

The total amount paid for repairs on engines, boilers, and boiler insurance was:

For repairs on boilers	$ 25 13
For boiler iusurance	125 00
For repairs on "Gaskill" engine	8 35
	$158 48

The total quantity of fuel purchased during the year was:

1,315 cords of pine slabs and edgings	$ 1,440 18
872 1680-2000 tons coal	2,117 35
	$3,557 53

Fuel on hand at the close of the year:

120 cords of pine slabs and edgings	$ 120 00
34 1800-2000 tons coal	69 80
	$189 80

Cost of fuel consumed during the year:

1,195 cords pine slabs and edgings	$ 1,320 18
837 1880-2000 tons coal	2,047 55
	$3,367 73

The total amount paid out during the year fo
pumping engines was:

For salaries of engineers and fireman .....$
" fuel .....
" oil packing and supplies .....
" repairs on engines and boilers and insur-
ance.....
" repairs on boiler arches .....

The net cost of operating the pumping engines w

For salaries .....$
" fuel consumed.....
" oil, packing and supplies used .....
" repairs and boiler insurance .....

The total quantity of water pumped during the y
by the revolutions of the pumping engines was 1,024,7
which 1,008,697,844 gallons were pumped against a
pressure of 40 lbs. per square inch at the gauge, or a
feet from the surface level of the water in the wells;
were pumped against an average fire pressure of 70 lb
at the gauge, equal to a lift of 182 feet from the surfa
in the wells. Average lift of all the water pumped,
figured on total pumping station expenses $7,467.09.

Per million gallons pumped.....
Per million gallons raised 100 feet.....

The cost of fuel was:

Per million gallons pumped.....
Per million gallons raised 100 feet.....

The pumping plant consists of

BOILERS:

Five in number, all horizontal return tubular boil
ate brick arches.

Three boilers are 16 feet long, 66 inches in dia
tubes 16 feet long and 2¾ inches interior diameter in e

Two boilers are 16 feet long, 60 inches in diameter
16 feet long and 3¾ inches interior diameter in each b

The area of grate surface under each boiler is as follows: No 1. 27½ square feet: Nos. 2 and 3, each 34 square feet: Nos. 4 and 5, each 22½ square feet. Heating surface: Nos. 1, 2 and 3 each, (½ shell 138 24-100, entire tubes 1209 51-100) 1347 75-100 square feet: Nos. 4 and 5 each, (½ shell 125 66-100, entire tubes 753 98-100) 879 64-100 square feet.

ENGINES AND PUMPS:

One "Gaskill" horizontal compound condensing, crank and fly wheel pumping engine, maximum capacity 5,000,000 gallons in 24 hours. One "Holly Quadruplex" compound condensing, crank and fly wheel pumping engine, maximum capacity 3,000,000 gallons in 24 hours. One horizontal, high pressure, piston engine, driving through gear two "No. 10 Holly" rotary pumps, maximum capacity 2,500,000 gallons in 24 hours.

Capacity of "Gaskill" pumps per revolution, 121 gallons.

Capacity of "Quadruplex" pumps per revolution, 55 gallons.

Capacity of Rotary pumps (2) per revolution, 17 gallons.

The Gaskill engines were run 8,713 35-60 hours, pumping 1,017,518,100 gallons; the quadruplex engines were run 46 55-60 hours, pumping 6,944,960 gallons: and the high pressure engine and rotary pumps were run 3 10-60 hours, pumping 272,561 gallons.

The greatest quantity of water pumped in one day was on the 3rd day of September, when 3,707,561 gallons were pumped: the least quantity pumped in one day was on the 22nd day of April, when 2,432,100 gallons were pumped. Daily average for year, 2,807,495 gallons.

The total quantity of water pumped each year since the works commenced operations has been as follows:

1873	142,477,725 Gallons	1884	831,867,463 Gallons
1874	294,714,798 "	1885	836,970,046 "
1875	416,756,579 "	1886	779,761,852 "
1876	518,197,129 "	1887	827,195,009 "
1877	538,847,186 "	1888	872,990,164 "
1878	530,197,397 "	1889	944,472,747 "
1879	672,344,128 "	1890	988 771,453 "
1880	827,087,372 "	1891	1,014,475,024 "
1881	944,382,043 "	1892	962,953,662 "
*1882	775,642,466 "	1893	1,044,256,286 "
1883	773,942,702 "	1894	1,024,735,621 "

* Commenced setting meters on large services in 1881.

WATER PUMPED 1894.

MONTH.	GASKILL ENGINES.			QUADRUPLEX ENGINES.			ROTARY PUMPS.			TOTALS.		FIRES.					
	Hours Run.	Revolutions.	Gallons Pumped	Hours Run.	Revolutions.	Gallons Pumped	Hours Run.	Revolutions.	Gallons Pumped	Gallons Pumped	Daily Aver'ge	No. Alarms.	Hours Run.	Highest Pressure	Lowest Pressure	Aver'ge Pressure	Gallons Pumped
January...	744	695,877	84,291,117							84,291,717	2,716,165	13	6.28	70	70	70	998,734
February.	672	661,864	80,085,544							80,085,544	2,860,198	8	10.43	70	60	67.7	1,883,486
March.....	730.10	677,189	81,939,869	13.50	36,539	3,009,645				83,949,514	2,708,049	8	2.32	70	70	70	405,108
April.....	720	635,573	76,904,333							76,904,333	2,563,478	11	4.57	70	70	70	683,529
May.....	734.45	669,432	81,001,272	9.15	24,471	1,345,905				82,347,177	2,656,361	15	6.08	70	70	70	973,566
June.....	715.20	735,214	86,115,155	5.10	12,234	672,870				86,788,025	2,892,934	8	5.46	80	70	73	1,041,326
July.....	741	814,048	98,499,808	3.00	8,331	458,205	3.10	16,033	272,561	99,230,574	3,200,986	18	15.32	75	70	71	3,233,501
August...	744	796,347	96 357,987							96,357,987	3,108,322	13	4.21	70	70	70	740,883
September	717.10	731,535	88,515,735	2.50	9,118	501,490				89,017,225	2,967,241	8	11.45	70	60	68	2,036,793
October...	740	677,448	81,971,208	4.00	12,179	669,845				82,641,053	2,665,840	11	5.10	70	70	70	817,859
November	711.25	646,441	78,219,361	8.35	22,632	1,244,760				79,464,121	2,648,804	17	9.15	70	70	70	1,474,869
December.	743.45	691,791	83,706,711	.15	768	42,240				83,748,951	2,701,579	9	4,47	70	70	70	748,143
Totals...	8,713.35	8,432,759	1,017,518,100	46.55	126,272	6,944,960	3.10	16,033	272,561	1,024,735,621	2,807,495	139	87.24	80	60	70	15,037,777

Main Distribution.

Distributing mains have been laid during the year as follows:

A 6-inch cast iron main pipe has been laid in Green avenue, from Center avenue south to the line of Seventh street, with one fire hydrant at the southern terminus of said pipe.

A 6-inch cast iron pipe has been laid in Atlantic street, from Parker street to Bismark street, with a fire hydrant at the northwest corner of Atlantic and Bismark streets.

Two 6-inch 3 way hydrants have been placed on the old 8-inch cast iron pipe in Water street, between Trumbull street and McEwan street. Two car loads of the 16-inch cast iron pipe for Water street from Sixteenth to Twenty-third street have been received. They were laid from Twenty-third street north to a point between Nineteenth and Twenty-first street, but as the water cannot be turned on to this pipe until it is completed and connection made at Sixteenth street, no fire hydrants have been connected therewith.

The fire hydrants connected with the old 16-inch main in Water street at Dolsen street, and at Mill street have been transferred to a connection with the new 20-inch main, and the old 6-inch and 4-inch pipes connecting these hydrants with the old main have been taken up or abandoned.

In addition to the above extensions 52 feet of 6-inch cast iron pipe and 725 feet of 4-inch cast iron pipe with two fire hydrants have been furnished, and laid by this department for Eddy Bros & Co. and Eddy, Sheldon & Co., the cost of which has been repaid by the parties named.

The 6-inch Wyckoff pipe on the south side of Center avenue was cut off about 40 feet west of Washington avenue, and the pipe abandoned from this point to where it was cut for the 20-inch main in Washington avenue. This was done to avoid tearing up a consid-

erable section of the stone walk in front of the Phoen
repair a leak, and as this was already a dead end pipe no
done to the system by its abandonment.

The 4-inch Wyckoff pipe in the alley between M
Monroe streets at a point about 50 feet north of Fifth stre
off and two sections of pipe removed on account of a le
dwelling placed over the pipe since it was laid; the ends
were plugged, making two dead ends. The alley in this
been closed, and the pipe should be laid in the street, and
pipe abandoned.

The total amount paid out during the year for extens
main distribution was as follows:

For cast iron pipe and specials	$ 1,44
" valves and valve boxes	15
" fire hydrants	14
" laying pipe	51
	$2,26

The cost of each line of pipe laid was:

Green avenue	$ 35
Atlantic street	18
Two hydrants on Water street	13
Water street from 23rd street north	1,05
Re-setting hydrant Water and Dolsen street	1
" " Water and Mill street	2
Eddy Bros. & Co and Eddy, Sheldon & Co. pipes	35
	$2,13

Value of material on hand purchased during the year,

Length of main pipe laid during the year not includ
pipe:

	10-in.	6-in.	4-in.
Cast Iron	1,209 feet	1,029 feet	20 feet

Length of pipe taken up or abandoned:

	6-in.	4-in.	Total.
Cast Iron	78 feet	17 feet	95 feet
Wyckoff Patent	60 "	16 "	76 "
Total	138 feet	33 feet	171 feet

Net increase in length of distributing mains in service, 2,087 feet.

Total length of distributing mains in service December 31st, 1894:

	CAST IRON.	WYCKOFF.	TOTAL.
20-inch	9,563 ft.		9,563 ft.
16-inch	13,778 "		13,778 "
12-inch	9,083 "		9,083 "
10-inch	9,948 2-12 "	34,140 4-12 ft.	44,088 6-12 "
8-inch	2,108 5-12 "	27,038 9-12 "	29,147 2-12 "
6-inch	5,441 6-12 "	92,072 6-12 "	97,514 "
4-inch	1,127 9-12 "	21,815 4-12 "	22,943 1-12 "
3-inch		319 "	319 "
Total	51,049 10-12 "	175,385 11-12 ft.	226,435 9-12 ft.

Total cast iron mains, 9 miles, 3,529 10-12 feet.
Total Wyckoff patent mains, 33 miles, 1,145 11-12 feet.
Total mains, 42 miles, 4,675 9-12 feet.

Percentage of each size:

20-inch	4.22 per cent.
16-inch	6.09 per cent.
12-inch	4.01 per cent.
10-inch	19.47 per cent.
8-inch	12.87 per cent.
6-inch	43.07 per cent.
4-inch	10.13 per cent.
3-inch	.14 per cent.
	100.00

VALVES.

The number of stop valves set in the distributing
the year was 7.

Four 6-inch, and three 4-inch, all Flower patent val

Whole number of valves in service December 31st,

	20-in.	16-in.	12-in.	10-in.	8-in.	6-in.	4-in
Flower Patent..	4	9	3	36	43	157	33
Galvin Patent..			2	1	1	5	4
Brown Patent..			1			1	
Total...	4	9	6	37	44	163	37

Blow off gates included in above:

Three	6-inch.
Seventeen	4-inch.
Two	3-inch.

FIRE HYDRANTS.

The number of fire hydrants added during the year

"Bourbon," with 6-inch inlet, 3 hose nozzles....
"Holly," with 4-inch inlet, 2 hose nozzles.....

Whole number of public fire hydrants in service D
1894, 370.

Matthews, 6-inch inlet, 3 hose nozzles, gates to nozz
Matthews, 4-inch inlet, 2 hose-nozzles.....
Bourbon, 6-inch inlet, 3 hose nozzles, gates to nozzl
Holly, 4-inch inlet, 2 hose nozzles, gates to nozzles
Holly, 4-inch inlet, 2 hose nozzles.....
Gaskill, 4-inch inlet, 2 hose nozzles.....
Gaskill Improved, 4-inch inlet, 2 hose nozzles.....
Galvin, 4-inch inlet, 2 hose nozzles.....
Morgan, 4-inch inlet, 2 hose nozzles .....
Brown, 4-inch inlet, 2 hose nozzles.....

Petitions have been presented to the board during the year for the following described lines of pipe:

McLellan street from Eighth to Tenth street.

Fifth avenue from Trumbull street to Park avenue.

Fourth avenue from Trumbull street to Park avenue.

Alley between Broadway and Howard street from Sixteenth to Twenty-third street.

Nebobish avenue from Park avenue to Annie street.

Woodside avenue from Belinda street to Trumbull street.

Atlantic street from Parker street to Woodside avenue.

Duplante street from Woodside avenue to Nebobish avenue.

High street from South Center street to Thirty-eighth street.

Petitions have been presented to the board in previous years for the following lines of pipe, which have not been laid:

Third street from Birney to Johnson street.

Campbell street from Sherman to Sheridan street.

Sheridan street from Campbell street to Woodside avenue.

Third street from Trumbull street to Park avenue.

Jackson street from Tenth to Eleventh street.

Lincoln avenue from Twelfth to Thirteenth street.

Thirteenth street from Sherman street to Lincoln avenue.

Madison avenue from Thirteenth to Twenty-second street.

Monroe street from Thirteenth to Sixteenth street.

The following described lines of pipe have been heretofore recommended by the superintendent, but not yet laid:

Harrison street from South Center to Forty-first (extension of iron main.)

Michigan avenue from Twenty-fifth to Fremont avenue.

Johnson street from Ninth to Twelfth street.

Campbell street from Sherman to Belinda street (removal of old main from Water Street.)

REPAIRS ON MAIN DISTRIBUTION.

The amount expended during the year on repairs to the main distribution system has been $670.56:

The number of leaks in the main pipes was 45, of wh
Wyckoff mains, and one in cast iron main. Nine leak
mains required the insertion of new sections of pipe,
out and not repaired, and thirty-three were repaired
being joint leaks or knot holes. The leak in the cast ir
caused by a slight starting of a lead joint, which wa
recaulking the lead.

The cost of repairing the 44 leaks in Wyckoff mains

For labor .....$
" material, pipe and sleeves.....
" repairing walks and pavements.....

The cost of repairing the leak in the cast iron main

The 6-inch Wyckoff main in Woodside avenue was r
way for the brick main sewer in Shearer street, and th
iron main in Water street was raised for the same main
16-inch cast iron main in Harrison street, the 8-inch Wy
Polk street, and the 6-inch Wyckoff main in Webste
raised for the brick main sewer in Thirty-fourth street.

The raising of the 12-inch and 16-inch cast iron mai
plished without cutting the pipe, and without shutting
of water through them. This was done by stripping ab
pipe each way from the line of the sewer, and the use o
as screws with chains passing under the pipe at equid
The 12-inch pipe was raised 22 inches, and the 16-inch
inches.

The fire hydrants at the corner of Woodside avenue
street, at the corner of Center avenue and Johnson s
Sixth street between Jefferson and Madison streets, hav
to conform to the grade of walks. The fire hydrant at
Woodside avenue and Sherman street, the one at
Twenty-fifth and Wilson street, and the one at the corn
seventh street and Garfield avenue were moved a short
their original location, the first on account of changes
line, the second by reason of its proximity to a shade
last to make way for a side track put in by the Michigan
Road Company. The expense of moving this last menti
was repaid to the department by the Railroad Company.

The location of a tile sewer at the corner of Eleventh and Van Buren street was changed by this department to avoid moving the fire hydrant on that corner. The cost of making the changes above mentioned, including the cost of the tools for raising the cast iron mains, and all labor and material used, was $166.41.

Twenty-nine cast iron extension valve boxes have been put in place of old wooden boxes which had become decayed, at a cost of $145.35.

The remainder of the repairs on main distribution consisted of a continuous investigation during severe cold weather for frozen hydrants; two thorough examinations of all of the hydrants in the city, blowing them out and oiling them, and some small repairs on valves. Most of these repairs were for labor, and amounted to $147.90.

The following table shows date, location and cha
leak in main pipes:

DATE.	PIPE.	LOCATION.	CHARAC
Jan 22	6-in. Wyckoff	Alley bet Monroe & Jackson, bet 2d and 3d	Burst.
Feb 8	6 " "	Center ave south side bet Saginaw and Washington	Joint.
March 3	6 " "	Fitzhugh street	Knot.
" 5	4 " "	Alley bet Madison and Monroe, bet 4th and 5th streets	Shakey
" 24	8 " "	18th street, at Howard street	Joint.
" 31	6 " "	McEwan street, near Woodside	Knot.
April 4	10 " "	Harrison street, bet 30th and 31st	Joint.
" 13	4 " "	Alley bet Saginaw and Washingt'n street, bet 5th and Center sts.	Burst.
May 14	4 " "	Harrison street, at 39th	Joint.
" 15	8 " "	Harrison street, bet 39th and 40th	Joint.
" 25	10 " "	South Center, bet Polk & Taylor	Knot.
June 11	10 " "	23d street, at Broadway	Knot.
" 13	6 " "	Water street, at 6th street	Joint.
" 23	6 " "	Alley bet Adams and Jefferson, bet 10th and 11th streets	Burst.
" 25	6 " "	Woodside ave west of Johnson	Knot.
" 27	6 " "	Woodside ave west of Johnson	Joint.
July 2	6 " "	Woodside ave, at Johnson	Shakey
" 6	8 " "	Harrison st, bet 40th and 41st sts.	Joint.
" 7	6 " "	Water street, bet 9th and 10th sts.	Joint.
" 9	6 " "	Sheridan street, at Center ave	Joint.
" 9	6 " "	Center ave, north side, bet Jefferson and Madison streets	Joint.
" 10	8 " "	Harrison street, bet South Center and 36th streets	Joint.
" 19	4 " "	Alley bet Jackson and VanBuren streets, bet 9th and 10th	Burst.
" 21	4 " "	Alley bet Jackson and VanBuren streets, bet 9th and 10th	Joint.
" 24	8 " "	18th st, bet Howard and Williams	Joint.
" 28	4 " "	Fitzhugh street, at 14th street	Knot.
" 28	10 " "	Johnson street, at 2nd street	Joint.
Aug 2	8 " "	Fremont ave, at Wilson street	Joint.
" 6	6 " "	Center ave, bet Washington and Adams	Joint.
" 8	4 " "	Harrison street, at 38th street	Joint.
" 16	4 " "	Alley bet Adams and Jefferson, bet 9th and 10th streets	Joint.
" 21	8 " "	Alley bet Jefferson and Madison streets, bet 5th and Center	Joint.
" 27	6 " "	Water street, bet 5th and Center	Shakey
Sept 7	6 " "	Water street, bet 9th and 10th	Shakey
" 10	8 " "	2d street, bet Jefferson & Madison	Joint.
" 17	10 " "	VanBuren street, bet 10th & 11th	Knot.
" 25	6 " "	Center ave, south side, at Lincoln	Joint.
" 26	12 " Cast iron	Trumbull st., north of Woodside	Lead jo
Oct 1	10 " Wyckoff	Garfield ave, at 26th street	Joint.
" 23	10 " "	Water street, at 19th street	Joint.
" 29	6 " "	Center ave south side, bet Washington and Adams street	Joint.
Nov 19	10 " "	Water street, bet 19th and 21st	Joint.
" 19	10 " "	Garfield ave, bet 27th and 28th sts.	Joint.
" 30	4 " "	Alley bet Adams and Jefferson, bet 4th and 5th streets	Joint.
Dec 24	10 " "	Fremont avenue, at Jennison ave.	Knot.

Burst or shakey pipe.....
Joints.....
Knot holes.....
Lead Joints.....

WATER METERS.

The number of water meters in service January 1st, 1894 was 459; the number of meters set during the year was 102, and the number removed was 45, making number of meters in service December 31st, 1894, 516.

The amount expended during the year on account of new meters and setting meters was $674.49.

76 new meters and freight	$ 617 54
Pipe fittings and meter connections	19 98
Labor setting and boxing meters	35 12
Nails	1 85
	$674 49

Of the 516 meters in service December 31st, 1894, 98 are classed as manufacturing, 416 as domestic and 2 are test meters.

The total amount expended by the department to December 31, 1894, on account of the purchase and setting of meters was $15,654.48, as follows:

Total cost of 516 meters, including setting	$ 13,442 89
Value of 51 meters on hand	1,378 87
Meter box covers and fittings on hand	79 28
Cost of setting 97 meters, and 2 indicators removed	753 44
	$15,654 48

Meters set in 1894:

	4-in.	3-in.	1-in.	¾-in.	⅝-in.	½-in.
Union Rotary	1	1			6	
Crown			2			2
Empire				3		3
Nash					11	
Worthington					2	
Hersey					3	
Hersey Disc					6	
Thomson					3	
Thomson Bee					3	36
Trident					12	
Westinghouse					1	
Totals	1	1	2	3	47	41

Meters taken out in 1894:

	3-in.	1-in	¾-in.	⅝-in.	½-in.
Union Rotary	4			1	
Union Duplex				1	
Crown		3	3		5
Empire		1	4		5
Nash				2	
Worthington				1	
Hersey				5	
Hersey Disc				1	
Thomson				1	
Thomson Bee					1
Total	4	4	7	12	11

Meters in service December 31st, 1894:

	8-in.	4-in.	3-in.	2-in.	1½-in	1-in.	¾-in.	⅝-in.	½-in.	⅜-in.	Total.
Union Rotary....	1	5	17	6	4	3	1	35			72
Union Duplex....								19			19
Crown.....					1	21	30		24	38	114
Empire.....						4	32		18		54
Gem....				1							1
Nash.....								9			9
Worthington				7	6			15			28
Hersey....						2	5	20			27
Hersey Disc.....								5			5
Thomson.....						2	2	102			106
Thomson. Bee ...								9	59		68
Trident								12			12
Westinghouse.. ..								1			1
Total..... ...	1	5	17	14	11	32	70	227	101	38	516

Meters in stock Dec 31st, 1894.

	4-in.	3-in.	1-in.	¾-in.	⅝-in.	½-in.	⅜-in.	Total.
Union Rotary.....	1	4			2			7
Union Duplex.....					3			3
Crown....			4	4		4	4	16
Empire.....			2	3		7		12
Nash.....					1			1
Worthington.....					1			1
Hersey					6			6
Hersey Disc.....					1			1
Thomson Bee.....					3	1		4
Total.....	1	4	6	7	17	12	4	51

REPAIRS ON METERS.

The amount expended during the year for the repair
water meters was $660.33 as follows:

Monthly inspection and reading	$
Repairs on one meter sent to shop	
Exchange on five new meters to replace old ones	
Parts of meters ordered for repairs	
Labor on meters repaired by inspector	
Labor on repairing meter boxes	
Labor taking out, cleaning and replacing meters	
Tools, etc	
	$

The number of meters found with parts broken or so
not register properly was 75, of which 69 were repa
Inspector and 6 were sent to the manufacturers for repa
them was repaired and returned, the other five were
injured beyond repair, and new meters returned to re
credit being given for the material in the old ones. Six
injured by frost, and two by hot water. 123 meters,
but not registering properly were taken apart and cleane

SUPPLY THROUGH METERS

The total quantity of water supplied through meters
year, not including a small quantity supplied for buildi
was 105,143,896 gallons, a decrease of nearly 5,000,000 gallo
year 1893.

The quantity supplied through meters for manufac
poses was 52,888,770 gallons, a decrease of 8,787,369 gallons
fair index of the depression which has existed in the ma
industries of the city during the year.

The quantity supplied through meters for domestic p
52,255,126 gallons, an increase of 3,835,249 gallons, but wh
is considered that the number of domestic meters has incr
17 per cent., while the quantity of water supplied throug
increased less than 8 per cent., it will be seen that the
been considerably less per meter than in 1893.

The total amount charged on the roll of 1894 for wa
through meters for manufacturing purposes was $4,795.45
of $745.52, and the amount charged for water supplied thr
for domestic purposes was $6,211.76, an increase of $685.59.

SERVICE CONNECTIONS AND SERVICES.

The number of new service connections made with the main pipes during the year was 58, of which 54 were made with corporation stops, and 4 were branch connections for large services. The number of service connections taken out was 8, of which 6 were corporation stops, and 2 branch connections.

The whole number of service connections in main pipes December 31st, 1894, is 1,932 of which 125 have been abandoned and are shut off at the main, leaving 1,837 with services connected.

The whole number of separate services supplied through these connections is 2,025.

Service connections put in 1894:

	Branches.			Corporation Stops.					Total.
	6-in.	4-in.	3-in.	1-in.	¾-in.	⅝-in.	½-in.	⅜-in.	
In cast iron mains.	1		2	1		5	5		14
In Wyckoff mains..		1		2	5	6	28	2	44
Total..... ...	1	1	2	3	5	11	33	2	58

Service connections taken out in 1894:

	Branches.	Corporation Stops.			Total.
	4-in.	1-in.	¾-in.	½-in.	
Cast iron mains.....	2				2
Wyckoff mains.....		1	2	3	6
Total.....	2	1	2	3	8

Total service connections in main pipes December 31st, 1894:

	BRANCHES					CORPORATION STOPS.							Total.
	8-in.	6-in.	4-in.	3-in.	2-in.	2-in.	1¼-in	1-in.	¾-in.	⅝-in.	½-in.	⅜-in.	
Iron m'ns		3	11	2	4	2	5	51	59	43	106	5	291
Wyckoff..	1	3	15	2	2	8		440	200	406	588	6	1,671
Totals....	1	6	26	4	6	10	5	491	259	449	694	11	1,962

Abandoned service connections:

	Branches.	Corporation Stops.				
	4-in.	2-in.	1-in.	¾-in.	⅝-in.	½-in
Cast iron mains....	3		7	6	3	11
Wyckoff	4	4	8	29	11	35
Totals.....	7	4	15	35	14	46

The amount expended during the year on account o
connections was $60.07:

For labor and material used on branch connections	$
" labor inserting 54 corporation stops.....	
" repairs on tools.....	

The amount received for service connection permits

REPAIR AND CARE OF SERVICES.

The amount expended during the year on account
and care of services, and turning on and off water was $

Labor and material used in repairing 11 leaks in 2-inch Wyckoff private mains.....	$
Labor repairing 5 leaks in services between main pipe and stop box.....	
Labor on repairs to service connections and repairing tools.....	
Labor turning on and off water.....	
Inspection of services.....	
Repairs on services boxes.....	
	$

The amount received from consumers on account of
was $11.20.

There were 11 leaks found and repaired in 2-inch pipes put in at private expense, and each supplying several consumers. There has been trouble heretofore in securing the prompt repair, and an equitable division of the cost among the several consumers supplied.

As most of these pipes are located on streets which are justly entitled to a main, there appears to be no injustice in this department keeping these pipes in repair until such mains are laid.

The leaks in lead services repaired by this department were caused by employes of this or other departments of the city government, or contractors making necessary excavations for public improvements, except one, which was caused by electrolytic action of the current from the lines of the Street Railway Company.

The number of services shut off by employes of this department during the year was 415, of which 145 were shut off at the request of the consumers, 133 were premises found vacant, 17 were shut on account of leaks, and 120 for non-payment of water rates. The number of services opened by employes of this department was 331.

The number of services open December 31st, 1894, was 1397 and the number shut off 628.

The thanks of this department are due to the heads of the several other departments of the city government for courtesies shown, and assistance given, and especially to Chief Harding, and the several members of the fire department for suggestions and valuable assistance in maintaining and promoting the efficiency of this department.

All of which is respectfully submitted.

E. L. DUNBAR,
Superintendent and Secretary.

Summary of Statistics.

REPORT FOR 1894.

Water Works of Bay City, Michigan.
Built in 1872.
Owned by the City.
Source of Supply, Saginaw Bay, an arm of Lake Hur
Mode of Supply, direct pumping.

PUMPING.

1. Builders of pumping machinery, Holly Manufacturi
2. Kind of fuel, coal and pine edgings.
3. Fuel consumed, 837 1880-2000 tons of coal, 1195 cords
   cost, $3,367.63.
6. Total water pumped in gallons, 1,024,735,621.
8. Average dynamic head, 113 feet.
   Cost of pumping based on pumping station expenses,
11. Per million gallons pumped, $7.29.
12. Per million gallons raised 100 feet, $6.45.
    Cost of pumping based on total maintenance, includ
    paid by city, $45,487.98.
13. Per million gallons pumped, $44 39.
14. Per million gallons raised 100 feet, $39.28.

CONSUMPTION.

1. Estimated population to date, 33,000.
2. Estimated population on pipe line, 19,500.
3. Estimated population supplied, 13,500.
4. Total gallons supplied, 1,024,735,621.
5. Passed through domestic meters, 52,255,126=5-10 per
6. Passed through manufacturing meters, 52,888,770=
   cent.
7. Average daily consumption, 2,807,495.

8. Gallons per day to each inhabitant, 83 8-10.
9. Gallons per day to each consumer, 208.
10. Gallons per day to each service (dist. 22), 1,528.

DISTRIBUTION.

MAINS.

1. Material, cast iron and Wyckoff patent.
2. Size, 3-inch to 20-inch.
3. Extended, 2,258 feet.
4. Discontinued, 171 feet.
5. Total in use, 43 miles.
6. Cost of repairs per mile, $15.59.
7. Leaks per mile, 1.
8. Small distribution less than 4 inches, 319 feet.
9. Hydrants added, 4.
10. Number of hydrants in use, 370.
11. Stop gates added, 7.
12. Number in use, 647.
13. Number of small gates less than 4 inches, 5.
14. Number of blow off gates, 21.
15. Ranges of pressure (domestic) at center day and night, 35 to 38 pounds.

SERVICES.

16. Material, lead, wrought iron and Wyckoff patent.
17. Sizes, ¾ inch to 8 inch.
21. Service taps added, 44.
22. Number in use, 1,837.
25. Meters added, 57.
26. Number in use, 516.

Financial.

MAINTENANCE.

RECEIPTS.—DIVISION I.

A	Water rates, domestic	$ 17,
B	Water rates, manufacturing	5,
C	Net receipts from water rates	
D	Miscellaneous, service connections, etc	
	Total receipts of water office	
	From Public Funds:	
J	Tax levy for interest on bonds	

DIVISION II.

	From Fixed Rates:	
L	Domestic	11,
M	Manufacturing	
N	Total	
	From Meter Rates:	
O	Domestic	5,
P	Manufacturing	4,
Q	Total	

EXPENDITURES.

AA	Management and repairs	16,
BB	Interest on bonds	28,
CC	Total maintenance	
DD	Balance to construction	

CONSTRUCTION.

R	Balance from previous years	$ 13,410 55		
	Balance from maintenance	6,576 74		
	Total		19,987 29	
FF	Extension of mains	2,261 17		
HH	Water meters	674 49		
	Coal House	1,113 50		
II	Total for construction		4,049 16	
JJ	Balance		15,938 13	
			$19,987 29	

Net cost of works to date	$ 555,702 16	
Bonded debt	362,000 00	

Material Used in Running Pumping

1894.

1,195 cords edgings	cost	$ 1,3
837 1880-2000 tons coal	"	2,0
185½ gallons cylinder oil	"	1
20 lbs. lubricant	"	
2 gallons lard oil	"	
5 lbs. plumbago	"	
7¾ lbs. cotton and hemp packing	"	
40½ lbs. 1-inch sq. packing	"	
1 lb. Heston cone packing	"	
2 lbs. Eureka packing	"	
1 lb. boiler gaskets	"	
2 lbs. wicking	"	
591 lbs wipers	"	
13 cans metal polish	"	
5½ lbs. Tripoli and rotten stone	"	
1 doz. brooms	"	
500 gallons kerosene oil	"	
67 boxes matches	"	
2 doz. lamp wicks	"	
24 lamp chimneys	"	
Soap	"	
Concentrated lye	"	
Red lead and oil	"	
Valve leathers and rivets	"	
Asphaltum	"	
Steam hose, etc	"	
Oil injector	"	
Ice for season	"	
Telephone, record blanks, etc	"	

USES SUPPLIED AT FIXED RATES, JANUARY 1st, 1895.

1 Ashery.
4 Bakeries.
1 Bank.
7 Barber shops.
2 Bath rooms (public).
1 Bath room (Turkish).
200 Baths (private).
4 Blacksmith shops.
6 Boarding houses.
5 Boilers (power)
7 Bottling works.
1 Broom factory.
14 Business blocks.
1 Business college.
6 Butcher shops.
3 Carriage shops.
6 Churches.
1 Cigar factory.
2 Clothes cleaning.
635 Dwellings.
1 Express office.
74 Families in blocks.
4 Fire pipes
3 Fountains.
1 Furniture factory.
1 Gas engine.
1 Gas works.
5 Halls (public).
3 Harness shops.
296 Hose for sprinkling.
14 Hotels.
1 Laboratory.
2 Laundries.
1 Machine shop.
1 Mattrass Factory.
22 Offices.
1 Paint shop.
1 Passenger depot.
1 Pawn shop.
4 Photograph galleries.
3 Plumbing shops.
1 Printing office.
2 Refrigerators.
9 Restaurants.
45 Saloons.
15 Schools.
1 Skating rink.
1 Shoe shop.
4 Stables (hotel).
8 Stables (livery).
6 Stables (mill).
100 Stables (private).
1 Stone yard.
77 Stores.
1 Tin shop.
1 Tailor shop.
1 Telegraph office.
1 Undertaker's room.
675 Water closets and urinals.
60 Water closets in schools.
8 Water moters.
2 Ware houses.

USES SUPPLIED THROUGH METERS, JANUAR

1	Armory.
3	Bakeries.
4	Banks.
246	Baths (private).
1	Bath room (public).
1	Barber shop.
1	Bicycle factory.
3	Boarding houses.
43	Boilers (power).
4	Boiler shops.
4	Bottling works.
6	Box factories.
1	Brewery.
19	Business blocks.
1	Business college.
2	Butcher shops.
1	Carpenter shop.
1	Canning works.
1	Carpet cleaning.
1	Cemetery.
1	Chapel.
5	Churches.
2	Club rooms.
2	Coal and wood yards.
1	County Jail.
1	County court house.
1	Cracker factory.
1	Cross arm factory.
1	Crystal water works.
4	Drill houses.
319	Dwellings.
1	Electric light station.
6	Elevator tanks.
21	Fire pipes.
2	Flouring mills.
4	Foundries.
3	Gas engines.
1	Government building.
3	Green houses.
10	Halls (public).
263	Hose for sprinklin
15	Hotels.
2	Laundries.
1	Locomotive round
1	Locomotive stand
8	Machine shops.
1	Masonic temple.
25	Offices.
1	Opera house.
2	Passenger depots.
1	Photograph gallery
1	Pipe factory.
1	Plumbing shop.
10	Planing mills.
1	Plow factory.
2	Printing offices.
1	Reel factory.
2	Restaurants.
1	Railroad car yard.
8	Saloons.
9	Salt blocks.
10	Saw mills.
2	Sash and door fact
1	School.
1	Stable (buss and ha
1	Stable (hotel).
7	Stables (mill).
7	Stables (livery).
71	Stables (private).
1	Stable (street-car).
40	Stores.
1	Undertaker's room.
759	Water closets and
54	Water motor pump
1	Ware house.
1	Wooden ware work

CITY USES FOR WHICH NO PAYMENT IS MADE.

1 City building occupied by police station and city offices.
1 City building occupied by public library and water office.
6 Steamer, hose and truck houses, 20 horses, 2 steamers, 2 chemicals.
17 Water closets and 6 baths in city buildings.
1 Electric light station.
11 Public watering troughs.
4 Ornamental fountains.
10 Hose for sprinkling parks.
370 Public fire hydrants.

USES SHUT OFF DECEMBER 31st, 1894.

24 Baths (private).
4 Boarding houses.
6 Blacksmith shops.
5 Barber shops.
1 Bank.
3 Business blocks.
2 Butcher shops
1 Billiard hall.
4 Boilers (power).
2 Bottling works.
2 Basement rooms.
1 Cooper shop.
3 Cemeteries.
217 Dwellings.
5 Drill houses.
1 Dry kiln.
1 Excelsior works.
1 Foundry
1 Fair ground.
5 Fire pipes.
1 Fish market.
157 Hose for sprinkling.
12 Hotels.
3 Halls (public).
1 Laundry.
1 Market garden.
3 Machine shops.
1 Mortar yard.
7 Offices.
1 Paint shop.
1 Paving block mill.
1 Plumbing shop.
1 Restaurant.
31 Stables (private).
1 Stable (street-car).
2 Soap factories.
18 Saloons.
3 Saw mills.
4 Salt blocks
1 Shingle mill.
1 Slaughter house.
1 Salt crusher.
61 Stores.
1 Tool house.
1 Turning shop.
90 Vacant lots.
80 Water closets and urinals.
3 Water motors.
1 Ware house.

Fire Hydrants, December 31st, 18

FIRST DISTRICT.

All North of the Center of First Street.

Record No.	Location.	No. Ho Connecti
370	Atlantic Street, N W Corner Bismark.	2
132	Atlantic Street, N W corner Parker.	2
128	McEwan street, W side, between Water street and McEwan Mill.	2
209	McEwan street, W side, in line of Campbell street.	2
216	McEwan street, W side, in line of Ketchum street.	2
217	Woodside avenue, N side, opposite Park avenue.	2
218	Park avenue, N W corner Nebobish avenue.	2
219	Park avenue, S W corner North street.	2
369	Water street, N side, 500 feet west of McEwan street.	3
368	Water street, N side, 400 feet east of Trumbull.	3
6	Trumbull street, E side, north of Mercer street.	2
37	Trumbull street, E side, in line of Barney.	2
179	Trumbull street, N W corner Woodside avenue.	2
178	Trumbull street, N W corner Nebobish avenue.	2
177	Trumbull street, N W corner North street.	2
736	Trumbull street, N W corner First street.	2
1	Water street, N side, at Pumping Station.	2
310	On Water Works grounds, rear of Pumping Station	3
	Water street, north side, opposite Dolsen street.	2
3	Water street, N side, opposite Mill street.	2
311	Water street, N side, between Mill and Belinda street.	3
4	Water street, N E corner Belinda street.	2
312	Belinda street, E side, between Water street and Saginaw river.	3
38	Belinda street, N W corner Fitzgerald street.	2
39	Belinda street, S E corner Ketchum street.	2
40	Woodside avenue, S side, opposite Belinda street.	2
151	Johnson street, N E corner First street.	2
5	Water street, N side, opposite Johnson street.	2
313	Water street, N side, opposite Shearer street.	3
129	Water street, N side in line of Seymour avenue.	2
314	Water street, N side, between Sherman street and Seymour ave.	3
315	Water street, N E corner Sherman street.	3
316	Water street, N E corner Scott Street.	3
317	Water street, N E corner Annie street.	3
318	Water street, N E corner Henry street.	3

Record No.	Location.	No. Connections.	Make
330	Water street, S E corner Henry street.	2	Matthews.
319	Water street, N side, between Henry and Jefferson street.	3	Matthews.
320	Water street, N side, opposite Jefferson street.	3	Matthews.
321	Water street, N side, opposite Adams street.	3	Matthews.
322	Water street, N side, opposite Washington avenue.	3	Matthews.
355	Campbell street, N E corner Sherman street.	2	Matthews.
7	Lord street, N W corner Annie street.	2	Holly.
8	Lord street, S W corner Henry street.	2	Holly.
9	Lord street, N side, opposite Madison avenue.	2	Holly
41	Woodside avenue, N W corner Shearer Street.	2	Holly.
42	Woodside avenue, S E corner Sherman street.	2	Holly.
290	Sherman street, N E corner First street.	2	Matthews.
82	Grant street, N E corner First street.	2	Holly.
70	Woodside avenue, N side, opposite Monroe street.	2	Holly.
72	First street, N side, at alley between Madison and Monroe streets.	2	Holly.
131	Woodside avenue, N E corner Adams street.	2	Matthews.
323	Washington avenue, N W corner First street.	3	Matthews.
36	Saginaw street, N end, in line of Woodside avenue.	2	Holly.
35	Water street, N E corner First street.	2	Holly.

SECOND DISTRICT.

Between Center of First Street and Center of Center Avenue.

34	Water street, N E corner Second street.	2	Holly.
181	Water street, N W corner Third street.	2	Holly.
182	Water street, w side, between Fourth and Fifth avenue.	2	Holly.
12	Third street, S side, at alley between Water and Saginaw street.	2	Holly.
13	Fourth avenue, S side, at alley between Water and Saginaw street.	2	Holly.
14	Fifth avenue, S side, at alley between Water and Saginaw street.	2	Holly.
97	Center ave., N side, at alley between Saginaw and Washington st.	2	Matthews.
11	Second st., N side, at alley between Saginaw and Washington st.	2	Holly.
324	Washington avenue, N W corner Second street.	3	Matthews.
325	Washington avenue, N W corner Third street.	3	Matthews.
326	Washington avenue, N W corner Fourth avenue.	3	Matthews.
161	Washington avenue, S W corner Fourth avenue.	2	Matthews.
327	Washington avenue, N W corner Fifth avenue.	3	Matthews.
328	Washington avenue, N W corner Center avenue.	3	Matthews.
141	Third street, S side, at alley between Washington and Adams st.	2	Matthews.
86	Fifth avenue, S side, at alley between Washington and Adams st	2	Holly.
91	Second street, S side, at alley between Adams and Jefferson st.	2	Matteews.
85	Center avenue, N side, at alley between Adams and Jefferson st.	2	Holly.
10	First street, S side, at alley between Jefferson and Madison st.	2	Holly.
16	Third street, N Side, at alley between Jefferson and Madison st.	2	Holly.
17	Fourth avenue, S side, at alley between Jefferson and Madison st.	2	Holly.
43	Fifth avenue, S side, at alley between Jefferson and Madison st.	2	Holly.
44	Center avenue, N side, at alley between Jefferson and Madison st.	2	Holly.
92	Second street, S W corner Madison avenue.	2	Matthews.
211	Fourth avenue, N side, at alley between Madison and Monroe st.	2	Matthews.
93	Second street, S E corner Jackson street.	2	Matthews.

Record No.	Location.	No. Connecti
94	Third street, S side, at alley between Monroe and Jackson street.	2
95	Fourth avenue, S side; at alley between Monroe and Jackson st.	2
96	Fifth avenue, S side, at alley between Monroe and Jackson st.	2
175	Van Buren street, S E corner Second street.	2
275	Van Buren street, N E corner Third street.	2
276	Van Buren street, N E corner Fourth avenue.	2
210	Fourth ave., N side at alley between Jackson and Van Buren st.	2
277	Van Buren street, N E corner Fifth avenue.	2
45	Van Buren street, N E corner Center avenue.	2
174	Grant street, S W corner Second street.	2
83	Grant street, N E corner Third street.	2
84	Grant street, N E corner Fifth avenue.	2
173	Farragut street, S W corner Second street.	2
172	Sherman street, S W corner Second Street.	2
291	Sherman street, N E corner Third street.	2
292	Sherman street, N E corner Fourth avenue.	2
293	Sherman street, N E corner Fifth avenue.	2
171	Sheridan street, S W corner Second street	2
46	Sheridan street, N W corner Center avenue.	2
170	Lincoln avenue, S W corner Second Street.	2
191	Lincoln avenue, N E corner Third street.	2
192	Lincoln avenue, N E corner Fourth avenue.	2
193	Lincoln avenue, N E corner Fifth avenue.	2
169	Birney street, S W corner Second street.	2
162	Birney street, N W corner Center avenue.	2
152	Johnson street, N E corner Second street.	2
153	Johnson street, N E corner Third street.	2
154	Johnson street, N E corner Fourth avenue.	2
155	Johnson street, N E corner Fifth avenue.	2
133	Johnson street, N E corner Center Avenue.	2
65	Chase street, S W corner Second street.	2
64	Pendleton street, S W corner Second street.	2
134	Pendleton street, N W corner Center avenue.	2
176	Trumbull street, N W corner Second street.	2
166	Trumbull street, N W corner Third street.	2
167	Trumbull street, N W corner Fourth avenue.	2
168	Trumbull street, N W corner Fifth avenue.	2
223	Center avenue, N side, between Trumbull and Park avenue.	2
220	Park avenue, E side, in center of Second Street.	2
221	Park avenue, E side, in center of Fourth avenue.	2
224	Park avenue, N W corner Center avenue.	2
222	Green avenue, W side, in center of Fourth avenue.	2
225	Green avenue, in center, on North side Center avenue.	2
286	Livingston avenue, N E corner Fourth avenue.	2
74	Livingston ave., E side, between Fourth avenue and Center ave.	2

THIRD DISTRICT.

Between Center of Center Avenue and Center of Ninth

183	Water street, W side, 50 feet south of Center avenue.	2
184	Water street, N W corner Seventh street.	2

Record No.	Location.	No. Connections.	Make.
185	Water street, N W corner Ninth street.	2	Holly.
15	Center ave., south side, at alley between Water and Saginaw st.	2	Holly.
18	Sixth st., S side, at alley between Water street and Saginaw st.	2	Holly.
19	Seventh st, S side, at alley between Water street and Saginaw st.	2	Holly.
20	Eighth st, S side, at alley between Water street and Saginaw st.	2	Holly.
21	Ninth st, N side, at alley between Water street and Saginaw st.	2	Holly.
215	Sixth st, N side, at alley between Saginaw and Washington st.	2	Matthews.
329	Washington, N W corner Sixth street.	3	Matthews.
330	Washington avenue, N W corner Seventh street.	3	Matthews.
331	Washington avenue, N W corner Eighth street.	3	Matthews.
322	Washington avenue, N W corner Ninth street.	3	Matthews.
53	Washington avenue, S E corner Center avenue.	2	Holly.
93	Sixth st, N side, at alley between Washington ave. and Adams st.	2	Matthews.
99	Seventh st, N side, at alley bet. Washington ave. and Adams st.	2	Matthews.
100	Eighth st, N side, at alley bet. Washington ave. and Adams st.	2	Matthews.
101	Ninth st, N side, at alley bet. Washington ave. and Adams st.	2	Matthews.
214	Eighth st, N side, at alley between Adams st. and Jefferson st.	2	Matthews.
47	Sixth st, S side, at alley bet. Jefferson st. and Madison avenue.	2	Holly.
48	Seventh st, S side, at alley bet. Jefferson st. and Madison ave.	2	Holly.
49	Eighth st, S side, at alley bet. Jefferson st. and Madison ave.	2	Holly.
50	Ninth st, N side, at alley bet. Jefferson st. and Madison ave.	2	Holly.
213	Eighth st, N side, at alley between Madison ave. and Monroe st.	2	Matthews.
51	Monroe street, S E corner Center avenue.	2	Brown.
102	Sixth street, N side, at alley bet. Monroe street and Jackson st.	2	Matthews.
103	Seventh st, S side, at alley bet. Monroe st. and Jackson street.	2	Matthews.
104	Eighth st, S side, at alley bet. Monroe st. and Jackson street.	2	Matthews.
105	Ninth st, N side, at alley bet. Monroe st. and Jackson street.	2	Matthews.
212	Seventh st, N side, at alley bet. Jackson st. and Van Buren st.	2	Matthews.
278	Van Buren street, N E corner Sixth street.	2	Matthews.
279	Van Buren street, N E corner Seventh street.	2	Matthews.
280	Van Buren street, N E corner Eighth street.	2	Matthews.
281	Van Buren street, N E corner Ninth street.	2	Matthews.
87	Grant street, S W corner Sixth street.	2	Holly.
88	Grant street, N E corner Eighth street.	2	Holly.
52	Farragut street, S W corner Center avenue.	2	Holly.
139	Farragut street, E side, in line of Seventh street.	2	Holly.
294	Sherman street, N E corner Sixth Street.	2	Matthews.
295	Sherman street, N E corner Eighth street.	2	Matthews.
296	Sherman street, N E corner Ninth street.	2	Matthews.
364	Sheridan street, N E corner Sixth street.	2	Matthews.
365	Sheridan street, N E corner Eighth street.	2	Matthews.
366	Sheridan street, N E corner Ninth street.	2	Matthews.
194	Lincoln avenue, N E corner Sixth street.	2	Matthews.
195	Lincoln avenue N E corner Eighth street.	2	Matthews.
196	Lincoln avenue N E corner Ninth street.	2	Matthews.
135	McLellan street, S W corner Center avenue.	2	Holly.
287	McLellan street, N E corner Sixth street.	2	Matthews.
288	McLellan street, east side in line Seventh street.	2	Matthews.
289	McLellan street, N E corner Eighth street.	2	Matthews.

Record No.	Location.	Conne
198	Johnson street, N E corner Sixth street.	
199	Johnson street, N E corner Seventh street.	
200	Johnson street, N E corner Eighth street.	
201	Johnson street, N E corner Ninth street.	
202	Ninth street, N side between Johnson and Trumbull streets	
136	Trumbull street, S E corner Center avenue.	
137	Trumbull street, S E corner Seventh street.	
297	Park avenue, N W corner Seventh street.	
298	Park avenue, west side in line of Ninth street.	
75	Green avenue in center in line of Seventh street.	

FOURTH DISTRICT.

Between Center of Ninth Street and Center of Thirt

23	Water street, S E corner Tenth street.	
24	Water street, east side, between Tenth and Eleventh streets	
25	Water street, N E corner Eleventh street.	
26	Water street east side, bet Eleventh st. and Columbus ave.	
27	Water street, N E corner Columbus avenue.	
55	Williams street, N E corner Thirteenth street.	
270	Garfield avenue, N E corner Thirteenth street.	
271	Saginaw street, N W corner Columbus avenue.	
272	Saginaw street, N W corner Eleventh street.	
273	Saginaw street west side, between Tenth and Eleventh sts.	
274	Saginaw street, S W corner Tenth street.	
333	Washington avenue, N W corner Tenth street.	
334	Washington avenue, west side, bet Tenth and Eleventh sts.	
335	Washington avenue, N W corner Eleventh street.	
336	Washington ave. west side, bet Eleventh st. and Columbus ave	
229	Columbus ave., N side, bet Saginaw st. and Washington ave.	
106	Tenth st, N side, at alley bet Washington ave. and Adams st.	
109	Eleventh st, S side, at alley bet Washington ave and Adams st	
180	Fitzhugh street, S E corner Columbus avenue.	
187	James street, S E corner Columbus avenue.	
186	Eleventh street, S side, at alley bet Adams and Jefferson sts.	
22	Tenth st., N side, at alley bet Jefferson st. and Madison ave.	
140	Madison avenue, S W corner Eleventh street.	
111	Thirteenth st. N side, between James st. and Madison ave.	
89	Jackson street, S W corner Tenth street.	
282	Van Buren street, N E Corner Tenth street.	
283	Van Buren street, E side, between Tenth and Eleventh sts.	
284	Van Buren street, N E corner Eleventh street.	
285	Van Buren street, N E corner Columbus avenue.	
113	Van Buren street, N E corner Thirteenth street.	
90	Grant street, S W corner Tenth street.	
233	Farragut street, N E corner Columbus avenue.	
107	Sherman street, N W corner Tenth street.	
108	Sherman street, N E corner Eleventh street.	
307	Sheridan street, N E corner Tenth street.	
357	Sheridan street, N W corner Columbus avenue.	

Record No.	Location.	No. Connections.	Make.
197	Lincoln avenue, N E corner Tenth street.	2	Matthews.
340	Lincoln avenue, N E corner Eleventh street.	2	Matthews.
391	Lincoln avenue, N E corner Columbus avenue.	2	Matthews.
358	Columbus avenue, N side, between Birney and McLellan sts.	2	Matthews.
359	Hampton street, N E corner Columbus avenue.	2	Matthews.
360	Johnson street, N W corner Columbus avenue.	2	Matthews.
361	Columbus avenue, N side, bet Johnson and Trumbull sts.	3	Matthews.
362	Trumbull street, N W corner Columbus avenue.	2	Matthews.
138	Trumbull street, S W corner Ninth street.	2	Holly
353	Tuscola road, NW corner Columbus avenue.	2	Matthews.
299	Park avenue, N W corner Ridge road.	2	Matthews.

FIFTH DISTRICT.

Between Center of Thirteenth and Center of Twenty-third Street.

54	Water street, S E corner Fourteenth street.	2	Holly.
28	Water street, S E corner Fifteenth street.	2	Holly.
29	Water street, N E corner Sixteenth street.	2	Holly.
30	Water street, N E corner Seventeenth street.	2	Holly.
31	Water street, N E corner Nineteenth street.	2	Holly.
60	Water street, N E corner Twenty-first street.	2	Holly.
61	Water street, S E corner Twenty-second street.	2	Holly.
348	Wilson street, N E corner Twenty-third street.	2	Matthews.
115	Marsac street, N E corner Twenty-third street.	2	Matthews.
58	Broadway, S W corner Eighteenth street.	2	Holly.
347	Broadway, N W corner Twenty-third street.	2	Crane.
59	Williams street, N W corner Eighteenth street.	2	Holly.
116	Twenty-first st, N side, at alley bet Howard and Williams sts.	2	Matthews.
117	Stanton street, N E corner Twenty-third street.	2	Matthews.
56	Fourteenth st, S side, at alley bet Williams st and Garfield ave.	2	Holly.
57	Sixteenth st, S side, at alley bet Williams st and Garfield ave.	2	Holly.
269	Garfield avenue, N E corner Fourteenth street.	2	Matthews.
268	Garfield avenue, N E corner Fifteenth street.	2	Matthews.
267	Garfield avenue, N E corner Sixteenth street.	2	Matthews.
266	Garfield avenue, N E corner Seventeenth street.	2	Matthews.
265	Garfield avenue, N E corner Eighteenth street.	2	Matthews.
264	Garfield avenue, S E corner Nineteenth street.	2	Matthews.
263	Garfield ave, E side, bet Nineteenth and Twenty-first sts.	2	Matthews.
262	Garfield avenue, N E corner Twenty-first street.	2	Matthews.
251	Garfield avenue, N E corner Twenty-second street.	2	Matthews.
156	Garfield avenue, N E corner Twenty-third street.	2	Holly.
110	Fraser street S E corner Thirteenth.	2	Matthews.
337	Fraser street, N E corner Fourteenth.	2	Matthews.
338	Fraser street, N E corner Fifteenth.	3	Matthews.
339	Fraser street, N E corner Sixteenth.	3	Matthews.
340	Fraser street, N E corner Seventeenth street.	2	Matthews.
341	Fraser street, N E corner Eighteenth street.	2	Matthews.
342	Fraser street, N E corner Nineteenth street.	2	Matthews.
343	Fraser street, E side, bet Nineteenth and Twenty-first sts.	2	Matthews.

Record No.	Location.	Con
344	Fraser street, N E corner Twenty-first street.	
345	Fraser street, N E corner Twenty-second street.	
346	Fraser street, N E corner Twenty-third street.	
142	Fitzhugh street, S W corner Fourteenth street.	
143	Fitzhugh street S W corner Fifteenth street.	
163	Fitzhugh street S W corner Seventeenth street.	
164	Fitzhugh street, S W corner Nineteenth street.	
165	Fitzhugh street, S W corner Twenty-first street.	
157	Fitzhugh street, N E corner Twenty-third street.	
205	Michigan avenue, east side, opposite Twenty-third street.	
204	Michigan avenue, N E corner Twenty-second street.	
112	Monroe street, S W corner Thirteenth street.	
203	Jackson street, N E corner Twenty-second street.	
302	VanBuren street, N E corner Fourteenth street.	
303	VanBuren street, N E corner Fifteenth street.	
304	VanBuren street, N E corner Sixteenth street.	
305	VanBuren street, N E corner Seventeenth street.	
306	VanBuren street, N E corner Eighteenth street.	
307	VanBuren street, N E corner Nineteenth street.	
308	VanBuren street, N E corner Twenty-first street.	
309	VanBuren street, N E corner Twenty-second street.	
190	Grant street, N E corner Twenty-second street.	
114	Sherman street, S W corner Thirteenth street.	
144	Sherman street, N E corner Fifteenth street.	
145	Sherman street, N E corner Seventeenth street.	
146	Sherman street, N E corner Nineteenth street.	
188	Sherman street, N E corner Twenty-first.	
189	Sherman street, N E corner Twenty-second.	

SIXTH DISTRICT.

Between Center of Twenty-third Street and Cent

62	Water street, N E corner Twenty-fourth street.	
63	Water street, N W corner Twenty-fifth street.	
349	Water street, N W corner Twenty-sixth street.	
350	Water street, N E corner Twenty-seventh street.	
66	Water street, N E corner Twenty-eighth street.	
67	Water street, N W corner Twenty-ninth street.	
68	Water street, N E corner Fremont avenue.	
241	Polk street, N E corner Thirtieth street.	
121	Webster street, S W corner Fremont avenue.	
32	Webster street, S E corner Twenty-third street.	
33	McCormick street, S E corner Twenty-third street.	
118	Wilson street, N E corner Twenty-fifth street.	
119	Wilson street, N E corner Twenty-eighth street.	
120	Wilson street, N E corner Fremont avenue.	
158	Broadway street, N E corner Twenty-fourth.	
159	Broadway street, N E corner Twenty-sixth.	
160	Broadway street, N E corner Twenty-eighth.	
122	Broadway street, S E corner Fremont avenue.	

Record No.	Location.	No. Connections.	Make.
254	Jennison avenue, S W corner Fremont avenue.	2	Matthews.
253	Jennison avenue, N W corner Thirtieth.	2	Matthews.
260	Garfield avenue, N E corner Twenty-fourth.	2	Matthews.
259	Garfield avenue, N E corner Twenty-fifth.	2	Matthews.
258	Garfield avenue, N E corner Twenty-sixth.	2	Matthews.
257	Garfield avenue, N E corner Twenty-seventh.	2	Matthews.
256	Garfield avenue, N E corner Twenty-eighth.	2	Matthews.
255	Garfield avenue, N E corner Fremont avenue.	2	Matthews.
247	Michigan avenue, east side, 50 feet north of Twenty-fourth.	2	Matthews.
248	Michigan avenue, N E corner Twenty-fifth.	2	Matthews.
246	Michigan avenue, N E corner Fremont avenue.	2	Matthews

SEVENTH DISTRICT.

All South of Center of Thirtieth Street.

234	River street, S W corner South Center street.	2	Matthews.
232	River street, N E corner Thirty-seventh street.	2	Matthews.
231	River street, east side, between Thirty-seventh and Fortieth sts.	2	Matthews.
230	River street, N E corner Fortieth street.	2	Matthews.
69	Harrison street, S E corner Thirtieth street.	2	Holly.
351	Harrison street, N E corner Thirty-first street.	3	Matthews.
352	Harrison street, N W corner Thirty-second street.	3	Matthews.
71	Harrison street west side opposite Thirty-third street.	2	Holly.
73	Harrison street, N W corner Thirty-fourth street.	2	Holly.
353	Harrison street, N W corner Thirty-fifth street.	3	Matthews.
354	Harrisoon street, N W corner South Center Street.	3	Matthews.
76	Harrison street, S E corner Thirty-sixth street.	2	Holly.
77	Harrison street, S W corner Thirty-seventh street.	2	Holly.
78	Harrison street, S E corner Thirty-eighth street.	2	Holly.
79	Harrison street, N E corner Thirty-ninth street.	2	Holly.
80	Harrison street, S W corner Fortieth street.	2	Holly.
81	Harrison street, S E corner Forty-first street.	2	Holly.
240	Polk street, N E corner Thirty-first street.	2	Matthews.
239	Polk street, N E corner Thirty-second street	2	Matthews.
238	Polk street, N E corner Thirty-third street.	2	Matthews.
237	Polk street, N E corner Thirty-fourth street.	2	Matthews.
236	Polk street, N E corner Thirty-fifth street.	2	Matthews.
235	Polk street, N E corner South Center.	2	Matthews.
126	Taylor Street, N W corner South Center.	2	Matthews.
226	Ingraham street, N E corner Thirty-sixth.	2	Matthews.
227	Ingraham street, N E corner Thirty-eighth.	2	Matthews.
228	Ingraham street, N E corner Fortieth.	2	Matthews.
206	Webster street, N E corner Thirty-first.	2	Matthews.
207	Webster street, N E corner Thirty-third.	2	Matthews.
208	Webster street, N E corner Thirty-fifth.	2	Matthews.
127	McCormick street, N W corner South Center street.	2	Matthews.
123	Broadway street, S E corner Thirty-first street.	2	Matthews.
124	Broadway street, S E corner Thirty-third street.	2	Matthews.
125	Broadway street, N E corner South Center street.	2	Matthews.

Record No.	Location.	No. Connecti
147	South Center street, N side, bet Stanton street and Jennison ave.	2
252	Jennison avenue, N W corner Thirty-first street.	2
251	Jennison avenue, N W corner Thirty-second street.	2
250	Jennison avenue, N W corner Thirty-third street.	2
249	Jennison avenue, N W corner Thirty-fourth street.	2
148	Bowery street, N E corner South Center street.	2
149	Fitzhugh street, N E corner South Center street.	2
150	Michigan avenue, N W corner South Center street.	2
242	Michigan avenue, N E corner Thirty-fifth street.	2
243	Michigan avenue, N E corner Thirty-fourth street.	2
244	Michigan avenue, N E corner Thirty-third street.	2
245	Michigan avenue, N E corner Thirty-first street.	2

Twenty-Fourth

Annual Report

OF THE

Water.... Department

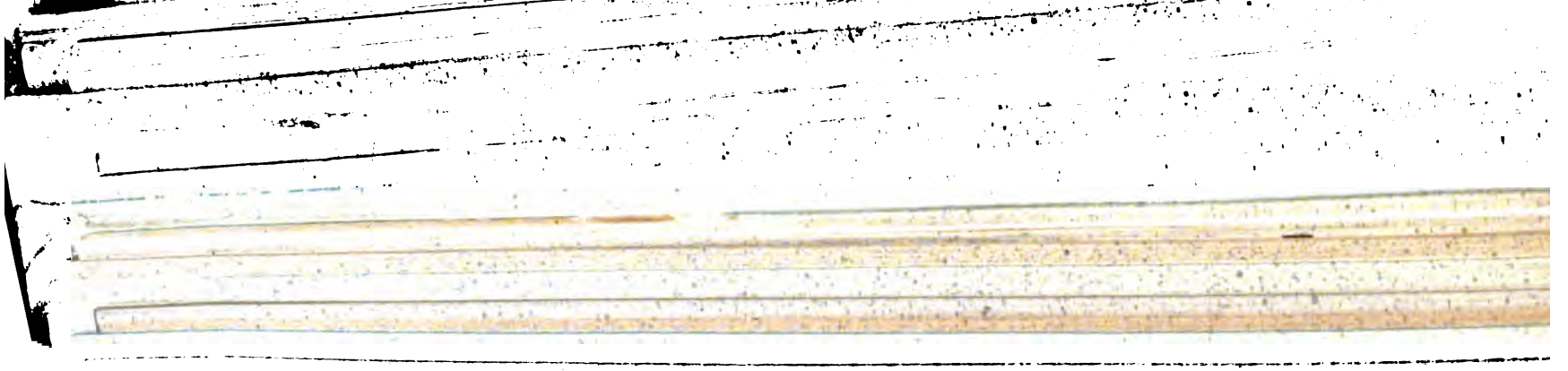
OF

BAY CITY, MICHIGAN,

DECEMBER 31st,

1895.

HURLEY BROS.,
PRINTERS, BINDERS AND STATIONERS
BAY CITY, MICH.



Twenty-Fourth

Annual Report

OF THE

Water.... Department

OF

BAY CITY, MICHIGAN,

DECEMBER 31st,

1895.

HURLEY BROS.,
PRINTERS, BINDERS AND STATIONERS,
BAY CITY, MICH.

Water Departme

1896.

Commissioners.

ANDREW WALTON, President.
Term expires Sept. 6th 1901.

G. HENRY SHEARER,
Term expired Sept. 6th 1895. (No appointment.)

BENJAMIN F. RAY,
Term expires Sept. 6th 1896.

SANFORD V. WILKIN,
Term expires Sept. 6th 1897.

LOUIS MORITZ,
Term expires Sept. 6th 1898.

DUNCAN McGREGOR,
Term expires Sept. 6th 1899.

FREMONT J. TROMBLE,
Term expires Sept. 6th 1900.

Officers and Employees.

Supt. & Secy.....E. L. D
Office Assistant,.....T. A. D
Inspector,.....F. H. C
Reservoir Keeper,.....L. D. C
First Engineer,.....A. B. V
Second Engineer,.....JAS. E.
Firemen,.....JAS. H.
PATRIC
Foreman on Repairs,.....THOMAS

Superintendent's Report.

TO THE HONORABLE BOARD OF COMMISSIONERS OF WATER WORKS:

GENTLEMEN:—I have the honor to submit the 24th annual report of the water department showing the operation of the works for the year ending December 31st, 1895.

The receipts of the department show a decrease of $734.42 from those of the preceeding year, of which $414.52 was in receipts from water rates and $319.90 from miscellaneous sources. The receipts for water supplied for domestic purposes were $105.55 less than in 1894, and from manufacturing purposes $308.97.

The quantity of water pumped has increased from 1,024,735,621 gallons in 1894 to 1,122,363,460 gallons in 1895, or nearly 100,000,000 gallons. This increase is mainly due to underground leakage from the main pipes, several large leaks having been discovered which had been running an unknown length of time, the water passing directly into the sewers without showing on the surface. This trouble has been largely reduced but not entirely overcome by the abandonment of the old main in Water street south of Sixteenth street, also between 5th and Center avenue, and between 9th and 10th streets; new cast iron mains having been laid in place of the pipes abandoned.

The most important work of the year has been the completion of the improvement at the inlet basin at the bay, commenced in 1894, and the commencement of the work of cleaning the inlet cut.

The work on these improvements was resumed in July and the inlet basin being completed early in October, it was determined to commence cleaning the inlet cut. Nearly 500 feet of the cut from the

basin out was cleaned before the inclemency of the
the work about the middle of November.

The breakwaters are now being extended across
of the inlet cut, and it will be practicable to continue
the cut at an early date in the spring.

This work should be done as early as practicable
low stage of water renders the maintenance of a full
certain until a deeper channel is secured across the

The experience of the past year has not confirmed
conveyed by the experience of the preceeding year, th
tion of the breakwater boom east of the mouth of the r
an effective barrier to the contamination of the presen
ply from the river discharge, while the quality of
good during the summer there was unmistakable evid
weeks after the spring freshets, and also after the he
occured in December, that the river discharge did ma
to the inlet works, and there is no question but the s
MUST be transferred to the west shore of the bay, in
the best water available, and the sooner this trans
better it will be for the health and prosperity of the
work done and in contemplation on the present inlet
essary in order to maintain the supply even if it shou
during the construction of a new inlet works, the
heretofore made that a pipe be laid from the present
through the inlet cut to deep water is withdrawn, ar
that the water be drawn through the open cut, and tha
be expended on cleaning the cut than is necessary t
ply equal to the full capacity of the present inlet pi
such decomposed matter as has a tendency to contamin

On account of the cost of the work at the inlet bu
done during the year on the extension of the main dis
10 inch cast iron main in Water street from 16th to 2
was commenced in 1894 has been completed and the c
street which has been a source of annoyance and ex
eral years has been abandoned. A 6 inch cast iron
laid on the west side of Water street from 5th to C
from 9th to 10th street, and the old main on thes

abandoned. An 8 inch cast iron main has been laid in Madison ave. from 13th to 23rd street. A 6 inch cast iron main in McLennan street from 8th to 10th street. A 6 inch cast iron main in 4th ave. from Trumbull street to Park ave. A 6 inch cast iron main in Livingston ave. from the line of 5th ave. to Centre ave. and east on Center ave. from Livingston ave. to the city limits.

FINANCIAL.

RECEIPTS.

The total receipts of the department for the year w
follows:

From water rates roll of 1888	$
" " " roll of 1889	
" " " roll of 1890	
" " " roll of 1891	
" " " roll of 1892	
" " " roll of 1893	
" " " roll of 1894	
" " " roll of 1895	2
Total from water rates	
From plumbers' licenses	
From rent of boom	
From service connections	
From repairs on main distribution	
From laying pipe	
Total miscellaneous	
Total receipts	

This amount has been deposited with the city t
receipts on file as follows:

January 31st,	1895	$
February 28th,	"	
March 30th,	"	
April 30th,	"	
May 31st,	"	
June 29th,	"	
July 31st,	"	
August 31st,	"	
September 30th,	"	
October 31st,	"	
November 30th,	"	
December 31st,	"	
		$2

The total amount charged on the assessment roll for the year 1895 was $23,225.81 as follows:

For water supplied at fixed rates	$11,682 77
For water supplied through meters	11.543 04
	$23,225 81

The amounts collected on roll of 1895 were:

From fixed rates	$11,362 26
From metered water	10,723 71
	$22.085 97

The amounts uncollected on roll of 1895:

From fixed rates	$320 51
From metered water	819 33
	$1,139 84

The amounts collected during the year from previous rolls were:

From fixed rates	$221 96
From metered water	98 38
	$320 34

The total amount charged on each year's roll since the works commenced operations, with the amount collected and the amount uncollected is as follows:

YEAR.	COLLECTED.	UNCOLLECTED.	TOTAL ON ROLL.
1873 January 1st to April 30th	$ 728 82		$ 728 82
1873-4 May 1st, 1873 to April 30th, 1874	5,440 80	$ 1 60	5.442 40
1874-5 May 1st, 1874 to April 30th, 1875	6.908 16	44 85	6.953 01
1875 May 1st to December 31st	7.269 55	28 46	7,298 01
1876	9.571 26	82 73	9,653 99
1877	9,604 26	134 19	9,738 45
1878	10,078 15	324 71	10.402 86
1879	11.708 97	136 07	11,845 04
1880	13,155 74	120 25	13,275 99
1881	15,002 61	212 40	15,215 01
1882	17,352 47	158 85	17,511 32
1883	18,713 46	98 64	18,812 10
1884	18,892 02	132 64	19.024 66
1885	19,716 73	270 58	19,987 31
1886	19,348 61	126 74	19,475 35
1887	19,435 25	88 00	19,523 25
1888	21.278 62	120 80	21,399 42
1889	22,120 47	113 03	22,233 50
1890	23,293 89	206 73	23,500 62
1891	24.617 51	292 41	24.909 92
1892	24.176 43	290 67	24.467 10
1893	23.588 91	571 26	24,160 17
1894	22,732 15	637 96	23,370 11
1895	22,085 97	1,139 84	23.225 81
	$386,820 81	$5,333 41	$392,154 22

EXPENDITURES.

The expenditures of the department for the year 1895 have been $29,251.69 for the following accounts:

For maintenance accounts:

Supt. and Sec'y's salary	$ 1,800 00	
Office assistant	800 00	
Office expenses	465 41	
Repairs on main distribution	664 47	
Repairs on services and turning on and off	316 08	
Repairs and care of water meters	657 59	
Repairs and care of inlet works	9,684 18	
Service connections	93 30	
Salaries of engineers and firemen	3,620 00	
Fuel	3,333 40	
Oil, Packing and supplies	325 84	
Repairs on engines and boilers	190 77	
Repairs on boiler arches	65 60	
Repairs to engine house	51 00	
Total for maintenance accounts		$22,067 64

For construction accounts:

Water meters	$ 434 36	
Setting meters	32 63	
Cast iron pipe	4,231 48	
Valves	213 93	
Fire hydrandts	452 21	
Laying pipe	1,819 44	
Total for construction accounts		$ 7,184 05
Total		$29,251 69

The total cost of maintenance, operation and repairs for the 24 years the works have been in operation is $264,808 34 and the net cost of construction to date is $562,885 25.

ACCOUNT WITH WATER WORKS FUND AND CITY TREASURER.

Balance in water works fund January 1st, 1895	$ 15,938 13	
Collections deposited to credit of fund	22,820 30	
Amounts withdrawn from Water Works fund on Recorders warrants No. 311 to 322 inclusive		29,251 69
Balance in Water Works fund Dec. 31st, 1895		9,506 74
	$38,758 43	$38,758 43

The City Treasurer acting as Treasurer of the Board has been charged with $29,251 69 as follows:

January 31st, 1895—Recorders Warrant No. 311					$1,551 74	
February 28th, "	"	"	"	312	988 76	
March 30th, "	"	"	"	313	1,036 14	
April 30th, "	"	"	"	314	2,735 72	
May 31st, "	"	"	"	315	3.186 10	
June 29th, "	"	"	"	316	1,777 64	
July 31st, "	"	"	"	317	2.932 81	
August 30th, "	"	"	"	318	3,183 56	
September 30th, "	"	"	"	319	4,142 48	
October 31st, "	"	"	"	320	3.628 19	
November 30th "	"	"	"	321	2.842 53	
December 31st, "	"	"	"	322	1,246 02	
And has paid orders of the Secretary of Board No. 2.671 to 3.509 inclusive						29,251 69
					$29.251 69	$29.251 69

The City Treasurer has paid the interest on the outstanding Water Works Bonds amounting to $27,110 00 from monies raised by tax levy. making total amount of interest paid on Water Works Bonds to Dec. 31, 1895, $659,875 00. Of the original issue of bonds for the construction of Water Works $20,000 fell due October 15th, 1895. These bonds were paid from the proceeds of the sale of $20,000 of new bonds leaving the whole amount of outstanding Water Works bonds $362,000 the same as last year. The new bonds issued draw but 4 per cent interest instead of 8 per cent. which was the rate on the bonds retired, thereby reducing the interest account $800 per year. The $20,000 new 4 per cent. bonds brought a premium of $799 00.

The following table shows the date of issue and date of payment of the Water Works Bonds outstanding Dec. 31st 1895.

SERIES.	DATE OF ISSUE.	PAYABLE.	AMOUNT.	INTEREST.
No 10.....	January 15, 1872.....	October 15, 1896.....	$10,000 00	8 per cent.
" 11.....	" " "	" " 1897.....	10.000 00	"
" 12.....	" " "	" " 1898.....	8,000 00	"
" 13.....	August " "	Feb'y 16, 1899.....	10,000 00	"
" 14.....	" " "	" " 1900.....	10,000 00	"
" 15.....	" " "	" " 1901.....	10,000 00	"
" 16.....	" " "	" " 1902.....	10,000 00	"
" 17.....	" " "	" " 1903.....	10,000 00	"
" 18.....	" " "	" " 1904.....	9,000 00	"
" 19.....	" " 1873.....	" " 1905.....	10,000 00	"
" 20.....	" " "	" " 1906.....	10,000 00	"
" 21.....	" " "	" " 1907.....	10,000 00	"
" 22.....	" " "	" " 1908.....	10,000 00	"
" 23.....	" " "	" " 1909.....	10.000 00	"
" 24. ..	Febr'y 15, 1874.....	" " 1910.....	10,000 00	"
" 25.....	April 15. "	April 15, 1911.....	10,000 00	"
" 26.....	" " "	" " 1912.....	10,000 00	"
" 27.....	" " "	" " 1913.....	20,000 00	"
" 30.....	October 15, 1874.....	October 15, 1896.....	10.000 00	"
" 31.....	" " "	" " 1897.....	10,000 00	"
" 32.....	" " "	" " 1898.....	10,000 00	"
" 33.....	March 1st, 1875.....	March 1st. 1900.....	10,000 00	"
" 34.....	" " "	" " 1901.....	10,000 00	"
" 35.....	June 1st, "	June " 1902.....	10.000 00	"
" 36.....	" " "	" " 1903.....	10,000 00	"
" 37.....	" " "	" " 1904.....	10,000 00	"
NOT SERIED.				
Nos. 1 to 25.	May 1st, 1891.....	May 1st, 1906.....	25.000 00	5 per cent.
" 26 to 50.	" " "	" " 1911.....	25,000 00	"
" 51 to 63.	" " "	" " 1917.....	12.500 00	"
" 64 .o 76.	" " "	" " 1918.....	12.500 00	"
REFUNDING.				
No. 1—20....	Oct. 1st, 1895.....	Oct. 1st, 1920.....	20,000 00	4 per cent.
			$362,000 00	

Balance of Accounts for 1895.

LEDGER E.

Folio 101,	Office Department Salaries	$ 2,600 00	
" 121,	" " Expenses	465 41	
" 122,	Street and Service Dep't, repairs on main distribution	648 87	
" 104,	" " " " on services, &c	316 08	
" 105,	" " " " and care of meters	657 59	
" 120,	" " " " and care of inlet works	9,684 18	
" 108,	Pumping Department Salaries	3,620 00	
" 109,	" " fuel	3,333 40	
" 123,	" " oil, packing, &c	325 84	
" 111,	" " repairs on engines and boilers	190 77	
" 111,	" " repairs on boiler arches	65 60	
" 119,	Repairs to engine house	51 00	
" 112,	Water Meters—new meters	434 36	
" 113,	" " —setting meters	32 63	
" 114,	Main distribution, cast iron pipe	4,231 48	
" 115,	" " valves	213 93	
" 116,	" " fire hydrants	452 21	
" 118,	" " laying pipe	1,818 43	
" 97,	Water rates Roll of 1888		12 17
" 97,	" " " 1889		2 02
" 97,	" " " 1890		11 15
" 96,	" " " 1891		1 20
" 96,	" " " 1892		14 45
" 96,	" " " 1893		29 65
" 95,	" " " 1894		249 70
" 93,	" " " 1895		22,085 97
" 98,	Plumbers licenses		60 00
" 98,	Rents, Dockage, &c		75 00
" 107,	Service connections		169 13
" 100,	City Water Works fund		6,431 39
		$29,141 83	$29,141 83

Balance Sheet, Bay City Water Works, Dec. 31st, 1895.

LEDGER E.

Folio 2,	Construction—real estate	$ 6,724 83	
" 2,	" dock tramway and shed	1,882 63	
" 3,	" engine house, chimney and wells	21,401 42	
" 3,	" engine foundations, boiler foundations and arches	6,777 45	
" 4,	" pumping machinery	59,427 72	
" 4,	" inlet from Saginaw River	3,218 99	
" 5,	" inlet from Saginaw Bay	84,778 37	
" 5,	" reservoir, &c., at bay	24,713 78	

"	6,	Construction—Iron pipe and branches	106.809 95		
"	6,	" Wyckoff patent pipe	126.441 31		
"	7,	" valves	15.739 60		
"	7,	" fire hydrants	14.920 50		
"	8,	" laying pipe	58.354 57		
"	8,	" buildings at bay	452 46		
"	9,	" water meters	16.121 47		
"	9,	" furniture and fixtures	990 96		
"	10,	" implement account	1,713 61		
"	10,	" engineering and general superintendence	7,856 17		
"	11,	" traveling expenses	306 29		
"	11,	" insurance	29 00		
"	12,	" interests, discounts and commissions	4,224 17		
"	13,	Maintenance—Office salaries and expenses	54,285 32		
"	13,	" repairs and care of hydrants, valves and pipes	16,529 87		
"	14,	" repairs and care of water meters	4,048 56		
"	14,	" repair to reservoir and inlet works	24,814 74		
"	15,	" repairs to dock	13 38		
"	15,	" repairs to engine house	1,390 06		
"	16,	" engineer's and firemen's wages	81,125 16		
"	16,	" fuel	61,464 39		
"	17,	" oil, packing and supplies	8,672 88		
"	17,	" repairs to pumping machinery	6,390 10		
"	18,	" repairs to engine foundations	51 46		
"	18,	" repairs to boiler arches	1,183 30		
"	19,	" implement account	1,129 37		
"	19,	" interest on bills payable	3,709 84		
"	20,	City Water Works fund	9,506 74		
"	1,	Bay City Bond account			443,04[illegible]
"	1,	Water assessment frontage on pipe			[illegible]
"	21,	Service taps and stop boxes			3,27[illegible]
"	21,	Rents, dockage, &c			2,55[illegible]
"	22,	Plumbers licenses			[illegible]
"	24,	Water rates			[illegible]
			$837,200 33		$837,200 33

Source of Supply and Inlet Works.

The continued lowering of level of the water in the bay has rendered it necessary to use a portion of the supply from the river a larger part of the time than ever before. While the entire supply has at no time been taken from the river, this source has been called upon to help out the supply from the bay a little more than 34 days, more than half of which was during the months of September and October when the level of the water in the bay had reached such a low stage, that a slight lowering of the water by a south-west wind of moderate strength, so reduced the capacity of the temporary inlet, used while the repairs to the inlet cut and basin were being made, as to compel the use of water from the river for a considerable portion of the time. Late in October, as there seemed to be no prospect of a favorable change in the conditions, the temporary inlet was lowered and a plank sluice put in for a distance of about 1,100 feet into the bay, after which it was not necessary to take any portion of the supply from the river.

The total amount expended on the repairs and care of inlet works was $9,684.18, as follows:

Salary of Reservoir Keeper	$ 420 00
30 inch gate for influent pipe to basin	104 73
30 inch pipe through dam	225 45
Masonry gate well in dam	831 48
1,570 square yards brick paving and laying	1,098 84
Laying 448 square yards cobble stone	66 00
Pumping	538 67
Lumber, &c., for pump house	35 05
Lowering temporary inlet and putting in sluice	130 85
Lumber for runways	13 59
Labor on dam	547 15
Labor on cleaning and deepening basin	3,246 40
Dynamite used in basin	135 50
Labor cleaning inlet cut	2,169 00
Tools and repairing tools	121 47
	$9,684 18

Pumping Station.

The amount expended for operating the pumping engines for the year was $7,535.61, as follows:

Salaries of engineers and firemen	$3,620 00	
Fuel	3,333 40	
Oil packing and supplies	325 84	
Repairs, engines and boilers	190 77	
Repairs, boiler arches	65 60	
		$7,535 61

and the net cost of operating the pumping engines was:

Salaries	$3,620 00	
Fuel consumed	3,344 74	
Oil, packing, &c., used	335 00	
Repairs, engines and boilers	190 77	
Repairs to boiler arches	65 60	
		$7,556 11

The salaries paid engineers and firemen were as follows.

First engineer's salary	$1,400 00	
Second engineer's salary	900 00	
Two firemen, each $660.00	1,320 00	
		$3,620 00

The fuel used during the year was principally coarse slack from Ohio mines, costing $2.00 per ton, delivered in the bins. The fuel on hand at the commencement of the year was:

120 cords pine slabs and edgings, cost	$ 120 00	
34 1800-2000 tons slack coal	69 80	
		$189 80

Fuel purchased during the year.

1463 1940-2000 tons slack coal @ $2.00	$2,927 94	
25 " " " @ 1.50	37 50	
41 500-2000 " lump " @ 2.65	109 30	
85 700-2000 " " " @ 3.00	256 06	
		$3,330 80
Paid hauling wood	2 60	
		$3,333 40

Fuel on hand December 31st, 1895.

91 cords wood, cost	$ 91 00	
10 500-2000 tons lump coal @ $2.65	27 16	
30 300-2000 tons slack coal " 2.00	60 30	
		$178 46

Fuel consumed during the year.

29 cords wood, cost	$ 31 60	
1,610 140-2000 tons coal	3,313 14	
		$3,344 74

The repairs on engines and boilers were as follows:

New fork end on connection rod of left Gaskill engine	$65 63
two sets new brasses for Gaskill engine	42 45
Relagging on cylinders Gaskill engine	8 10
Pump valves, Gaskill engine	18 20
Repairs on Quadruplex engines and pumps	5 35
Repairs on boilers	7 00
Liners and boxing fire fronts and grate bars	40 85
Gas pipe and fittings	3 19
	$190 77

The total quantity of water pumped during the year was 1,122,363,460 gallons, of which 1,104,619,085 gallons were pumped against a pressure of 40 lbs. per square inch, at the pressure gauge on the pumping engines, which is equivalent to a lift of 112 feet from the level of the surface of the water in the wells, and 17,744,375 gallons were pumped against an average fire pressure of 72 2-10 lbs. at the gauge, or a lift of 187 feet from the surface of the water in the wells.

Average lift of all water pumped 113 feet. Cost, figuring on total pumping station expenses, $7,556.11

Per million gallons pumped	$ 6 73
" " " raised 100 feet	5 95

The cost of fuel was:

Per million gallons pumped	$2 98
" " " raised 100 feet	2 63

The right Gaskill engine and pump were run 8;681 15-60 hours and the left Gaskill engine and pump 8,647 hours.

Total quantity of water pumped by Gaskill engines, 1,106,483,774 gallons.

The Quadruplex engines were run 187 hours, pumping 15,338,950 gallons.

The Rotary pumps were run 6 15-60 hours, pumping 540,736 gallons.

There were 141 alarms of fire received at the pumping station during the year and the works were run under fire pressure 86 20-60 hours.

The greatest quantity of water pumped in one day was 4,394,027 gallons, July 25th, and the least quantity 2,550,438 gallons. Dec. 25th. The daily average for the year was 3,074,968 gallons.

The total quantity of water pumped each year since the Works commetced operations has been as follows:

1873	142,477,725 Gallons	1884	831,867,463 Gallons
1874	294,714,798 "	1885	836,970,046 "
1875	416,756,579 "	1886	779,761,852 "
1876	518,197,129 "	1887	827,195,009 "
1877	538,847,186 "	1888	872,990,164 "
1878	530,197,397 "	1889	944,472,747 "
1879	672,344,128 "	1890	988,771,453 "
1880	827,067,372 "	1891	1,014,475,024 "
1881	944,382,043 "	1892	962,953,662 "
1882	775,642,466 "	1893	1,044,256,236 "
1883	773,942,702 "	1894	1,024,735,621 "

1895 ..... 1,122,363,460 gallons.

The pumping plant consists of

BOILERS:

Five in number, all horizontal return tubular boilers set in separate brick arches.

Three boilers are 16 feet long, 66 inches in diameter, with 105 tubes 16 feet long and 2¾ inches interior diameter, in each boiler.

Two boilers are 16 feet long, 60 inches in diameter, with 48 tubes 16 feet long and 3¾ inches interior diameter, in each boiler.

The area of grate surface under each boiler is as follows:

No. 1, 27½ square feet: Nos. 2 and 3, each 34 square feet; Nos. 4 and 5, each 22½ square feet. Heating surface; Nos. 1, 2 and 3, each 1[illegible]

shell 138 24–100 square feet, entire tubes 1209 51-100 square feet) 1347 75–100 square feet. Nos. 4 and 5, each (½ shell 125 66–100 square feet, entire tubes 753 98–100 square feet) 879 64–100 square feet.

ENGINES AND PUMPS:

One "Gaskill" horizontal compound condensing, crank and fly wheel pumping engine, maximum capacity 5,000,000 gallons in 24 hours.

One "Holly Quadruplex" compound condensing, crank and fly wheel pumping engine, maximum capacity, 3,000,000 gallons in 24 hours.

One horizontal high pressure, piston engine, driving through gears, two "No. 10 Holly" rotary pumps, maximum capacity 2,500,000 gallons in 24 hours.

Capacity of "Gaskill" pumps per revolution, 121 gallons.

Capacity of "Quadruplex" pumps per revolution, 55 gallons.

Capacity of Rotary pumps (2) per revolution, 17 gallons.

WATER PUMPED 1895.

MONTH.	GASKILL ENGINES.			QUADRUPLEX ENGINES.			ROTARY PUMPS.			TOTALS.		FIRES.					
	Hours Run.	Revolutions.	Gallons Pumped.	Hours Run.	Revolutions.	Gallons Pumped.	Hours Run.	Revolutions.	Gallons Pumped.	Gallons Pumped.	Daily Average.	No. Alarms.	Hours Run.	Highest Pressure	Lowest Pressure	Average Pressure	Gallons Pumped.
January...	739:15	725,855	87,828,455	4:45	14,400	702,000				88,620,455	2.858,724	14	12:02	70	70	70	2,060,751
February..	671:15	746.152	90.284,392	:45	2,800	114,950	:45	4.379	74,443	90,473,785	3,231,207	6	7:14	70	70	70	1,601,072
March.....	743:45	819,891	99,206,811	:15	573	31,515	:15	1,271	21,607	99,259,933	3,201,933	13	10:56	75	70	72	2,189,374
April.....	715:05	722,650	83,005,999	45:55	53,327	2,794,330				85,800,329	2,860.011	14	8:46	90	70	72	1,504,030
May.....	741:30	721.366	87,285,286	9:30	19,569	742,555				88,027.841	2 839,608	13	5:24	80	70	71	909,315
June.....	714:15	841,438	94.444,615	116	179,250	9,247,975	3:25	17,017	289,289	103,981,879	3,466,063	12	12:10	80	65	74	3,586,132
July.....	741:30	912.196	110,375,716	2:30	7,600	422,950	1:50	9,141	155,397	110,954.063	3,579,163	16	10:51	80	70	75	2,487,430
August....	742	821,100	99,353,100	2	6,253	342,815				99,695,915	3.215.997	12	5:35	80	70	73	1.137,763
September	718:10	791,007	95,711,847	1:50	6,050	333,080				96,044,927	3,201,498	12	3:33	70	70	70	639,606
October...	743	735,720	89.022.120	1	2,950	162,580				89,184,700	2,876,926	16	3:59	70	60	70	667,799
November.	720	690.111	83,503,431							83,503,431	2.783,448	10	4:51	70	70	70	790,372
December.	741:30	714,562	86,462,002	2:30	6,450	354,200				86,816,202	2,800,523	3	:59	70	70	70	170,731
TOTALS..	8,731:25	9,242,048	1,100,483,774	187	320,454	15,338,950	6:15	31,808	540,736	1,122,363,460	3,074,968	141	86:20	90	60	72 3-10	17,744,375

The left Gaskill Pump was run independent of the right Gaskill Pump 50 hours in April, making 73,300 revolutions.
The right Gaskill Pump was run independent of the left Gaskill Pump 84½ hours in June, making 121,808 revolutions.
The right side of the Quadruplex was run 38 hours in April independent of the left side, making 65,042 revolutions.
The right side of the Quadruplex was run 2 hours in May independent of the left side, making 12,136 revolutions.
The right side of the Quadruplex was run 1 hours in June independent of the left side making 32,980 revolutions.
The left back Pump of the Quadruplex was run 12 hours in June, independent of the left front, making 31,500 revolutions.

Main Distribution.

The total amount expended during the year for the extension of the main distribution system was $6,717.06, as follows.

For cast iron pipe and special castings	$4,231 48
For valves	213 93
For fire hydrants	452 21
For laying pipe	1,819 44
	$6,717 06

The cost of each of the several lines of pipe laid was as follows:

High Street from South Center to 38th Street	$ 707 92
Water Street from 16th to 23rd Street, (balance)	1,519 88
Water Street from 9th to 10th Streets	221 37
Water Street from 5th to Center Avenue	263 63
Madison Avenue from 13th to 23rd Streets	2,224 29
McLellan Street from 8th to 10th Streets	369 88
Fourth Avenue from Trumbull Street to Park Ave.	735 24
Livingston Avenue from 5th to Center Avenue	248 28
Center Avenue from Livingston Ave. to City Limits	426 57
	$6,717 06

The total length of pipe laid during the year, all of which was cast iron, was as follows:

10 inch pipe	1,259¼ feet
8 "	3.120 "
6 "	4,801 "
4 " hydrant branches	294½ "
Total	9,475¼ feet

Length of pipe taken out or abandoned during the year:

	10 inch.	8 inch.	6 inch.	4 inch.	TOTAL.
Cast Iron	40 ft.	14 ft.	14½ ft.	40 ft.	108½ ft.
Wyckoff Patent	2,414¼ "		787 "	15 "	3,216¼ "
Total	2,454¼ ft.	14 ft..	801½ ft.	55 ft.	3,325¼ tf.

Length of distributing mains in service December 31st, 1895.

	CAST IRON.	WYCKOFF.	TOTAL.
20 inch	9,563 ft.		9,563 ft.
16 inch	13,778 "		13,778 "
12 inch	9,083 "		9,083 "
10 inch	11,167 11-12 "	31,725 7-12 ft.	42,893 6-12 "
8 inch	5,214 5-12 "	27,038 9-12 "	32,253 3-12 "
6 inch	10,228 "	91,285 6-12 "	101,513 6-12 "
4 inch	1,382 3-12 "	21,800 4-12 "	23,182 7-12 "
3 inch		319 "	319
Total	60,416 7-12 ft.	172,169 2-12 ft.	232,585 9-12 "

Total cast iron mains.....11 miles....2,336 7-12 feet
Total Wyckoff patent.....32 miles....3,209 2-12 feet
Total mains.....44 miles.... 265 9-12 feet

Percentage of each size of pipe:

20 inch.....4.11 per cent
16 " .....5.92 "
12 " .....3.91 "
10 " .....18.45 "
8 " .....13.86 "
6 " .....43.64 "
4 " ..... 9.97 "
3 " ..... .14 "
100.

The number of valves set in the distributing mains during the year was 30, as follows:

8 inches.....2
6 inches.....7
4 inches.....21
30

And the number of valves taken out:

8 inches..... 1
6 inches..... 1
4 inches..... 5
7

Making number of valves in service December 31st, 1895, 670 as follows:

	20 in.	16 in.	12 in.	10 in.	8 in	6 in.	4 in.	3 in.	TOTAL.
Flower Patent..	4	9	3	37	44	163	350	5	615
Galvin Patent..			2		1	5	45		53
Brown Patent..			1			1			2
Total.....	4	9	6	37	45	169	395	5	670

Blow off gates included in above:

Three	6 inch.
Seventeen	4 inch.
Two	3 inch.

One 10 inch Galvin valve has been taken out and a 10 inch Flower valve set in place of it.

The number of fire hydrants added during the year was 17, as follows:

One Holly.....2 way
Four Matthews.....2 way
Ten Bourbon.....2 way
Two Bourbon .....3 way with gates

Whole number of fire hydrants in service December 31st, 1895, 387.

Matthews, 6 inch inlet, 3 hose nozzles, gates to nozzles..... 32
Matthews, 4 inch inlet, 2 hose nozzles.....184
Bourbon, 6 inch inlet, 3 hoze nozzles, gates to nozzles..... 5
Bourbon, 4 inch inlet, 2 hose nozzles..... 10
Holly, 4 inch inlet, 2 hoze nozzles, gates to nozzles..... 5
Holly, 4 inch inlet, 2 hose nozzles.....128
Gaskill, 4 inch inlet, 2 hose nozzles..... 15
Gaskill, improved, 4 inch inlet, 2 hose nozzles..... 1
Galvin, 4 inch inlet, 2 hose nozzles..... 5
Morgan, 4 inch inlet, 2 hose nozzles..... 1
Brown, 4 inch inlet, 2 hose nozzles..... 1
Total.....387

REPAIRS ON MAIN DISTRIBUTION.

The amount expended during the year, on account of repairs on Main Distribution was $664.47, as follows:

Labor and material repairing 46 leaks in mains	$195 61
Labor on Washington Avenue pipe on account filling sewer	42 35
Labor and material raising pipes and moving hydrants	32 51
Labor examining and thawing hydrants and flushing pipes	123 50
Hydrants and parts of hydrants for repairs	101 40
Labor and shop repairs on hydrants	92 90
Labor and shop repairs on valves	22 06
Cast iron valve boxes, to replace wood	39 00
Tools and repairing tools	15 14
	$664 47

The number of leaks in main pipes discovered and repaired during the year was 46, of which 45 were in Wyckoff mains and 1 in cast iron mains.

The old wooden box sewer in Washington Avenue, between 5th and Center Avenues, was found to be in a decaying condition and it was decided to fill the same before relaying the pavement on that street, as this sewer lay partially beneath the 20 inch cast iron main pipe, it was necessary to place supports under this pipe, while the work was being done and to prevent future displacement of the pipe. Heavy cedar posts were placed at each joint and left there.

The hydrant at the corner of Center and Washington Avenues, was moved a short distance to permit a change in the curb line. The 6 inch pipe in Center Avenue, at the intersection of Park Avenue, was lowered to make way for deepening of the culvert in Park Avenue.

The 10 inch pipe in Johnson Street, between First Street and Woodside Avenue, was raised to make way for a private sewer.

The 10 inch Galvin valve in Trumbull Street, at the intersection of Second Street, was broken in an unsuccessful effort to close it to make a connection with the new 6 inch main in Fourth Avenue and it was taken out and replaced by a Flower valve.

DATE.			LEAKS IN MAIN PIPES, 1895	CHARACTER.
Jan.	3, 1895	6 in. Wyckoff	Water street, bet. 9th and 10th sts	Knot.
Mar.	22, "	8 " "	Madison avenue, at 13 st	Joint.
Apr.	4, "	10 " "	Van Buren street, bet. 4th and 5th sts	Knot.
"	15, "	8 " "	Alley, bet. Jefferson and Madison sts., bet. 8th and 9th sts	Knot.
May	1, "	8 " "	Alley, bet. Jefferson and Madison sts., bet. 10th and 11th sts	Knot.
"	2, "	10 " "	Van Buren st., bet. 4th and 5th sts	Knot.
"	2, "	4 " "	Alley, bet. Adams and Jefferson sts., bet. 7th and 8th sts	Joint.
"	11, "	6 " "	Water st., bet. 9th and 10th sts	Bands gone.
"	22, "	10 " "	Second st., at Johnson	Joint.
"	31, "	10 " "	Second st., bet. Madison and Monroe sts.	Joint.
June	1, "	6 " "	Thirteenth street, at Madison	Joint.
"	1, "	8 " "	Madison avenue, at 13th	Joint.
"	15, "	10 " "	Second street, at Madison	Joint.
"	15, "	6 " "	Water street, bet. 9th and 10th sts	Bands gone.
"	19, "	6 " "	Water Street, bet. 9th and 10th sts	Bands gone.
"	22, "	10 " "	Garfield avenue, bet. 26th and 27th sts	Joint.
July	1, "	6 " "	Thirteenth st., bet. Williams and Bowery	Joint.
"	2, "	4 " "	Alley, bet. Madison and Monroe sts., bet. 9th and 10th sts	Joint.
"	10, "	8 " "	Second street, at Monroe	B. gone sl've
"	13, "	10 " "	Garfield avenue, bet. 21st and 22nd sts	Knot.
"	15, "	8 " "	Harrison st., bet. 35th and S. Center	Joint.
"	15, "	10 " "	Jennison avenue, bet. 34th and 35th sts	Joint.
"	16, "	10 " "	Garfield avenue, bet. 26th and 27th sts	Joint.
"	17, "	8 " "	Alley, bet. Jefferson and Madison sts., bet. 10th and 11th sts	Joint.
"	25, "	8 " "	Harrison street, bet. S. Center and 36th sts.	B. gone sl've
"	26, "	6 " "	Ingraham street, bet. 36th and 37th sts	Joint.
"	29, "	8 " "	Second street, bet. Monroe and Jackson sts	Joint.
"	29, "	8 " "	Michigan avenue bet. 23rd and 24th sts	Knot.
Aug.	13, "	8 " "	Alley, between Jefferson and Madison sts., bet. 5th and Center avenue	B. gone sl've
"	14, "	8 " "	Alley bet. Jefferson and Madison sts., bet. Center ave. and 6th st	Joint.
"	16, "	8 " "	Eighteenth street, bet. Williams and Howard sts	Joint.
"	16, "	6 " "	Alley, bet. Williams and Howard, at 18th st	Joint.
"	19, "	6 " "	Woodside avenue, bet. Grant and Farragut	Joint.
"	20, "	6 " "	Alley, bet. Williams st. and Garfield ave., bet. 17th and 18th sts	Joint.
"	2[illegible]	" " "	Water street, bet. 4th and 5th sts	Joint.
"	3[illegible]	" " "	Alley, bet. Monroe and Jackson sts., bet. 4th and 5th sts	Joint.
Sept.	17, "	6 " "	Water street, bet. 3rd and 4th	Joint.
"	3 "	6 " "	Center avenue, s side bet. Jefferson and Madison sts	Joint.
"	25, "	8 " "	Michigan avenue, at Fremont ave	Joint.
Oct.	2, "	6 " "	Grant street, bet. 1st st. and Woodside ave.	Joint.
"	2, "	8 " "	Harrison street, bet. 35th and S. Center sts.	Joint.
"	3, "	8 " "	Harrison street, bet. 36th and 37th sts	Joint.
"	7, "	6 " "	Center avenue (s side) bet. Adams and Jefferson sts	Joint.
Nov.	4, "	6 " "	Grant street, bet. 4th and 5th sts	Joint.
"	30, "	6 " "	Water street, at 9th st	B. gone sl've
July	22, "	12 " cast iron	Trumbull street, at Fitzgerald st	Joint.

WATER METERS.

The amount expended during the year on the extension of the meter system was $466.99.

50 new meters bought	$432 66
Pipe, fittings and labor setting meters	34 33
	$466 99

The number of meters set was 78 and the number removed, 35, making net increase in number of meters in service 43 and whole number of meters in service 559 of which 88 are classed as manufacturing, 469 are classed as domestic and 2 are test meters.

The total amount expended on the meter system to date is $16,121.47.

Cost of 559 meters, including setting	$13,786 59
Value of 58 meters in stock	1,383 82
Fittings, etc., in stock	74 73
Amount expended in setting 110 meters and 2 indicators removed and not replaced	876 33
	$16,121 47

The meters removed and not replaced were taken out because the use of water on the premises was abandoned, or the premises were supplied through other services.

Meters set in 1895:

	4 in	3 in.	1 in.	¾ in	⅝ in	½ in	⅜ in	Total
Union Rotary	1	3	....	....	5	....	....	9
Union Duplex	....	....	....	....	1	....	....	1
Crown	....	....	4	4	....	5	3	16
Empire	....	....	2	3	....	2	....	7
Nash	....	....	....	....	5	....	....	5
Worthington	....	....	....	....	1	....	....	1
Hersey	....	....	....	....	5	....	....	5
Hersey Disc	....	....	....	....	6	....	....	6
Thomson Bee	....	....	....	....	3	13	....	16
Trident	....	....	....	....	12	....	....	12
Total	1	3	6	7	38	20	3	78

Meters taken out in 1895:

	3 in.	2 in.	1½ in	1 in.	¾ in	⅝ in	½ in	⅜ in	Total.
Union Rotary	3	1	1	....	1	....	....	....	6
Union Duplex	....	....	....	....	....	3	....	....	3
Crown	....	....	....	5	3	....	4	1	13
Empire	....	....	....	2	4	....	....	....	6
Worthington	....	....	1	....	....	....	....	....	1
Hersey	....	....	....	....	....	1	....	....	1
Thomson	....	....	....	....	1	3	....	....	4
Thomson Bee	....	....	....	....	....	....	1	....	1
Total	3	1	2	7	9	7	5	1	35

Meters in service December 31st, 1895.

	8 in.	4 in.	3 in.	2 in.	1½ in	1 in.	¾ in	⅝ in	½ in	⅜ in	Total.
Union Rotary	1	6	17	5	3	3	....	40	....	....	75
Union Duplex	....	....	....	....	....	....	....	17	....	....	17
Crown	....	....	....	....	1	20	31	....	25	40	117
Empire	....	....	....	....	....	4	31	....	20	....	55
Gem	....	....	....	1	....	....	....	....	....	....	1
Nash	....	....	....	....	....	....	....	14	....	....	14
Worthington	....	....	....	7	5	....	....	16	....	....	28
Hersey	....	....	....	....	....	2	5	24	....	....	31
Hersey Disc	....	....	....	....	....	....	....	11	....	....	11
Thomson	....	....	....	....	....	2	1	99	....	....	102
Thomson Bee	....	....	....	....	....	....	....	12	71	....	83
Trident	....	....	....	....	....	....	....	24	....	....	24
Westinghouse	....	....	....	....	....	....	....	1	....	....	1
Total	1	6	17	13	9	31	68	258	116	40	559

Meters in stock December 31st, 1895.

	3 in.	2 in.	1½ in	1 in.	¾ in	⅝ in	½ in	⅜ in	Total
Union Rotary	4	1	1	....	1	2	....	....	9
Union Duplex	....	....	....	....	....	5	....	....	5
Columbia	....	....	....	....	....	5	....	....	5
Crown	....	....	....	5	3	....	3	2	13
Empire	....	....	....	2	4	....	5	....	11
Nash	....	....	....	....	....	1	....	....	1
Worthington	....	....	1	....	....	....	....	....	1
Hersey	....	....	....	....	....	2	....	....	2
Thomson	....	....	....	....	1	3	....	....	4
Thomson Bee	....	....	....	....	....	....	1	....	1
Trident	....	....	....	....	....	6	....	....	6
Total	4	1	2	7	9	24	9	2	58

REPAIRS AND CARE OF METERS.

The amount expended during the year on account of the repair and care of water meters was $657.59 as follows:

Monthly inspection and reading	$227.50
Repairs on 5 meters sent to shop	17.13
Exchange on 1 new meter to replace ⅜ in.	7.50
Parts of meter for repairs	95 68
Labor on repairing meters	183 55
Labor and material repairing meter boxes	21 00
Labor taking out and replacing meters	30 00
Labor cleaning meters	71 50
Tools, &c.	3 73
Total	$657 59

Ten meters were removed on account of the use of water on the premises supplied having been abandoned; four were removed because the premises were supplied through other meters, and twenty one were replaced by other meters: eleven meters were injured by frost, of which six were sent to the manufacturers for repairs, and five were repaired by the inspector: of the six returned to the manufacturers, five were repaired, and one was injured beyond repair, for which a new meter was returned.

Seventy-five meters have been found broken in some of their parts, and repaired by the inspector, ninety-eight have been found not registering properly, but with none of their parts broken, these have been taken to pieces and thoroughly cleaned and returned to duty.

SUPPLY THROUGH METERS.

The total quantity of water supplied through meters was 104,122,052 gallons of which 51,033,957 gallons were supplied for manufacturing purposes and 53,088,095 gallons for domestic use.

The total amount charged on the roll of 1895 for water supplied through meters was $11,543,04 of which $5,006,56 was charged for water supplied for manufacturing purposes and $6,536 48 was charged for water supplied for domestic use.

SERVICES.

The number of new service connections made with the main pipes during the year was 89, of which 39 were to replace connections taken out or abandoned, and 50 were for supplying premises not heretofore supplied.

The mumber of service connections taken out was 54, of which 7 were for supplying services heretofore reported as abandoned but not taken out; 37 were for supplying premises on which the service was renewed through new connections made and 10 were for supplying premises on which the use of water has been permanently discontinued.

The number of service connections abandoned but not taken out was 28.

The whole number of service connections with main pipes Dec. 31st, 1895, is 1997, of which 146 have been abandoned and are shut off at the main, leaving 1851 with services connected. Total number of separate services supplied through these connections is 2048. The amount expended on account of new service connections was $93 30.

For corporation stops and material purchased.....$35 30
For labor inserting taps 58 00

$93 30

The amount received for service connections was $262 43.

Service connections put in 1895:

	BRANCHES.		CORPORATION STOPS.				TOTAL.
	8 in.	4 in.	1 in	¾ in.	⅝ in.	½ in.	
In Cast Iron Mains	1	2	7	7	15	10	42
In Wyckoff mains			4	12	9	22	47
Total.....	1	2	11	19	24	32	89

Service connections taken out in 1895:

	BRANCHES		CORPORATION STOPS.						TOT'L
	4 in.		2 in.	1¼ in	1 in.	¾ in.	⅝ in.	½ in.	
In Cast Iron Mains.....	1			1	1				3
In Wyckoff Mains.....	2		4		13	15	3	14	51
Total.....	3		4	1	14	15	3	14	54

Service connections in main pipes Dec. 31st, 1895:

	BRANCHES.					CORPORATION STOPS.								TOT'L
	8 in	6	4	3	2	2 in	1 ¼	1	¾	⅝	½	⅜		
In Cast Iron Mains	1	3	12	2	4	2	4	57	66	58	116	5		330
In Wyckoff Mains.	1	3	13	2	2	4		431	197	412	596	6		1,667
Total	2	6	25	4	6	6	4	488	263	470	712	11		1,997

Abandoned connections not removed:

	BRANCHES.		CORPORATION STOPS.						TOT'L
	4 in.		2 in.	1 in.	¾ in.	⅝ in.	½ in.	⅜ in.	
Cast Iron Mains	2			8	9	4	11	4	38
Wyckoff Mains.	3		2	15	37	12	39		108
Total.....	5		2	23	46	16	50	4	146

REPAIRS AND CARE OF SERVICES.

The amount expended during the year on account of repairs to services and turning on and off water was $316.08.

Labor and materials used in repairing 6 private mains	$ 38 18	
Labor repairing 1 lead service	3 25	
Labor taking out service connections	12 25	
Labor turning on and off	227 25	
Examining services	34 75	
Repairing tools	40	
		$316 08

The number of services opened by employees of this department during the year was 367. The number of services shut off was 364 of which 57 were shut off at the request of the consumer, 117 were premises found vacant, 13 for leaks, 104 by reason of the use of water having been temporarily discontinued, and 73 for non-payment of rates.

The total number of services open December 31st, 1895, is 1447, and the number shut off is 601.

Respectfully submitted,

E. L. DUNBAR,

SUPT. AND SEC'Y.

Summary of Statistics.

REPORT FOR 1895.

Water Works of Bay City, Michigan.
Built in 1872.
Owned by the City.
Source of supply; Saginaw Bay, an arm of Lake Huron.
Mode of supply; direct pumping.

PUMPING.

1. Builders of pumping machinery, Holly Manufacturing Co.
2. Kind of fuel, slack coal from Ohio mines.
3. Fuel consumed, 1,610 140-2,000 tons coal, 29 cords wood.
6. Total water pumped in gallons, 1,122,363,460.
8. Average dynamic head, 113 feet.

Cost of Pumping, based on pumping station expenses, $7,556.11.

11. Per million gallons pumped, $6.73.
12. Per million gallons raised 100 feet, $5.95.

Cost of Pumping, based on total maintenance including interest paid by City Tax, $49,177.64.

13. Per million gallons pumped, $43.82.
14. Per million gallons raised 100 feet, $38.71.

CONSUMPTION.

1. Estimated population to date, 33,000.
2. Estimated population on pipe lines, 20,000.
3. Estimated population supplied, 14,000.
4. Total gallons supplied, 1,122,363,460.
5. Passed through domestic meters, 53,088,095 4 73-100 per cent.
6. Passed through manufacturers meters, 51,033,957 4 55-100 per cent.
7. Average daily consumption, 3,074,968.
8. Gallons per day to each inhabitant, 93.
9. Gallons per day to each consumer, 219.
10. Gallons per day to each service, (dist. 22), 1,661.

DISTRIBUTION.

MAINS.

1. Material, cast iron and Wyckoff patent.
2. Size, 3 inch to 20 inch.
3. Extended 9,475 feet.
4. Discontinued., 3,325 feet.
5. Total in use, 44 miles.
6. Cost of repairs per mile, $16.01.
7. Leaks per mile, 1.
8. Small distribution, less than 4 inch, 319 feet.
9. Hydrants added, 17.
10. Number of hydrants in use, 387.
11. Stop gates added. 23.
12. Number in use, 670.
13. Number of small gates less than 4 inches, 5.
14. Number of blow off gates, 22.
15. Ranges of pressure (domestic) at center day and night, 35 to 38 pounds

SERVICES.

16. Material, lead, wrought iron and Wyckoff patent.
17. Size, 3-8 to 8 inch.
21. Service taps added, 14.
22. Number in use, 1,851.
25. Meters added, 43.
26. Number in use, 559.

Financial—Maintenance.

RECEIPTS—DIVISION I.		
A. Water rates, domestic	$17,514 55	
B. Water rates, manufacturing	4,891 76	
C. Net receipts from water		$22,406 31
D. Miscellaneous service connections, etc.		413 99
E. Total		$22,820 30
From public funds—		
J. Tax levy for interest		27,110 00
		$49,930 30

DIVISION II.		
From fixed rates—		
L. Domestic	$11,184 63	
M. Manufacturing	398 39	
N. Total		$11,583 02
From meter rates—		
O. Domestic	6,329 92	
P. Manufacturing	4,493 37	
Q. Total		$10,823 29

EXPENDITURES.		
A. A. Management and repairs	$22,067 64	
B. B. Interest paid by tax levy	27,110 00	
C. C. Total maintenance for year		$49,177 64
D. D. Balance to construction		752 66
		$49,930 30

Construction.

R. Balance from previous years	$15,938 13	
Balance from maintenance	752 66	
Total		$16,690 79
		$16,690 79

F. F. Extension of mains	$ 6,717 06	
H. H. Water meters	466 99	
I. I. Total for construction		$7,184 05
Balance		9,506 74
		16,690 79

W. Net cost of works to date ..... $[illegible]2,385.25.
X. Bonded Debt ..... $[illegible]0,000.00

Material Used in Running Pumping Engines, 1895.

29 cords slabs	cost	$	31 60	
1610 140-2000 tons coal	"		3,313 14	
				$ 3,344 74
229 gallons cylinder oil	"		119 81	
22 lbs. lubricant	"		1 86	
6½ gallons lard oil	"		3 97	
5 lbs. plumbago	"		1 00	
11¼ " cotton and hemp packing	"		3 67	
1¼ " wicking	"		38	
1½ " Garlock and Eureka packing	"		1 00	
12 " rubber packing	"		6 55	
21¼ " leather	"		6 09	
662 " wipers	"		30 86	
7 cans metal polish	"		1 40	
5 lbs. tripoli and rotten stone	"		40	
13 brooms	"		3 30	
495 gallons kerosene oil	"		35 03	
85 boxes matches	"		1 00	
Lamp wicks and chimneys	"		1 60	
Soap and lye	"		8 48	
Red lead and oil	"		86	
Asphaltum	"		3 00	
Emery, Babbitt, etc	"		9 69	
Gauge cocks, glasses and oilers	"		17 50	
Steam hose, etc	"		16 55	
Ice for season	"		12 00	
Telephone and record blanks	"		49 00	335 00
				$ 3,679 74

USES SUPPLIED AT FIXED RATES, JANUARY 1st, 1896.

1 Ashery.
2 Automatic sprinklers.
3 Bakeries.
1 Bank.
8 Barber shops.
2 Bath rooms (public).
1 Bath room (Turkish).
202 Baths (private).
2 Blacksmith shops.
4 Boarding houses.
7 Boilers (power).
6 Bottling works.
11 Business blocks.
1 Business College.
7 Butcher shops.
3 Carriage shops.
4 Churches.
1 Cigar factory.
2 Clothes cleaning.
638 Dwellings.
1 Dye works.
1 Express office.
74 Families in blocks.
2 Fire pipes.
1 Fountain.
1 Furniture factory.
1 Gas engine.
1 Gas works.
1 Green house.
6 Halls (public)
3 Harness shops.
285 Hose for sprinkling.
12 Hotels.
1 Laboratory.
2 Laundries.
1 Machine shop.
1 Mattrass factory.
22 Offices.
1 Paint shop.
1 Passenger depot.
1 Pawn shop.
4 Photograph galleries.
3 Plumbing shops.
2 Printing offices.
2 Refrigerators.
10 Restaurants.
41 Saloons.
15 Schools.
1 Shoe shop.
3 Skating rinks.
4 Stables (hotel).
7 Stables (livery).
5 Stables (mill).
91 Stables (private).
1 Stone yard.
79 Stores.
1 Tailor shop.
1 Telegraph office.
1 Tin shop.
1 Undertaker's room.
681 Water closets & urinals
60 Waterclosets in schools
6 Water motors.
2 Ware houses.

USES SUPPLIED THROUGH METERS, JANUARY 1st, 1896.

1 Armory.
3 Bakeries.
3 Banks.
2 Barber shops
1 Bath room (public).
286 Baths (private).
1 Bicycle factory.
1 Blacksmith shop.
3 Boarding houses.
41 Boilers (power).
4 Boiler shops.
3 Bottling works.
6 Box factories.
1 Brewery.
22 Business blocks.
1 Business College.
3 Butcher shops.
1 Candy factory.
1 Carpenter shop.
1 Carpet cleaning works.
1 Canning works.
1 Cemetery.
5 Churches.
2 Club rooms.
2 Coal and wood yards.
1 Court house.
1 County jail.
1 Cracker factory.
1 Cross arm factory.
1 Crystal water works.
5 Drill houses.
360 Dwellings.
1 Electric light plant.
6 Elevator tanks.
22 Fire pipes.
2 Flour mills.
4 Foundries.
2 Gas engines
1 Government building.
3 Green houses.
8 Halls (public).
15 Hotels.
289 Hose for sprinkling.
2 Laundries.
1 Locomotive round house
1 Locomotive stand pipe.
8 Machine shops.
1 Masonic temple.
27 Offices.
1 Opera house.
2 Passenger depots.
1 Pipe factory.
13 Planing mills.
1 Plow factory.
1 Photograph gallery.
2 Printing Offices.
1 Rail road car yard.
1 Reel factory.
1 Refrigerator.
2 Restaurants.
8 Saloons.
9 Salt blocks.
10 Saw mills.
2 Sash and door factories.
1 School.
1 Stable (buss and hack.
2 Stables (hotel).
6 Stables (mill).
8 Stables (livery).
1 Stable (street car).
75 Stables (private).
45 Stores.
1 Telegraph office.
2 Undertaker's rooms.
798 Water closets and Urinals
58 Water moter pumps.
1 Ware house.
1 Wooden ware works.

USES SHUT OFF DECEMBER 31st, 1895.

19 Baths. (private).
1 Bank.
6 Barber shops.
1 Bakery.
1 Basement (vacant).
1 Billiard hall.
6 Blacksmith shops.
4 Boarding houses.
7 Boilers (power).
1 Boiler shop.
2 Bottling works.
1 Broom factory.
2 Butcher shops.
1 Business block.
1 Carpenter shop.
3 Cemeteries.
1 Church.
1 Cooper shop.
5 Drill houses.
1 Dry kiln.
200 Dwellings.
1 Excelsior factory.
1 Fair grounds.
8 Fire pipes.
1 Fish market.
2 Foundries.
3 Halls (public).
152 Hose for sprinkling.
11 Hotels.
1 Laundry.
3 Machine shops.
1 Market garden.
1 Mortar yard.
8 Offices.
1 Paint shop.
1 Paving block factory.
1 Planing mill.
1 Plumbing shop.
1 Restaurant.
23 Stables (private).
1 Stable (livery).
2 Stables (mill).
18 Saloons.
2 Saw mills.
3 Salt blocks.
1 Salt crusher.
1 Shingle mill.
1 Slaughter house.
2 Soap factories.
50 Stores.
1 Tool house.
1 Turning shop.
86 Vacant lots.
74 Water closets and urinals
2 Water motors.
2 Ware houses.

CITY USES FOR WHICH NO PAYMENT IS MADE.

1 City building occupied by police station and city offices.
1 City building occupied by public library and water office.
6 Steamer truck and hose houses, 20 horses, 2 steamers, 2 chemicals.
17 Water closets and 6 baths in city buildings.
1 Electric light station.
11 Public watering troughs.
4 Ornamental fountains.
10 Hose for sprinkling parks.
2 Street sprinkling carts.
387 Public fire hydrants.

Twenty-Fifth

Annual Report

OF THE

WATER DEPARTMENT,

OF

BAY CITY, MICHIGAN.

DECEMBER 31, 1896.

BAY CITY, MICH.:
JAS. GRAY, PRINTER AND STATIONER.
1897.

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1897.

WATER DEPARTMENT.

1897.

Commissioners.

SANFORD V. WILKIN, PRESIDENT.
(Term Expires Sept. 6th, 1897.)

LOUIS MORITZ,
(Term Expires Sept. 6th, 1898.)

DUNCAN McGREGOR,
(Term Expires Sept. 6th, 1899.)

FREMONT J. TROMBLE,
(Term Expires Sept. 6th, 1900.)

ANDREW WALTON,
(Term Expires Sept. 6th, 1901.)

G. HENRY SHEARER,
(Term Expires Sept. 6th, 1902.)

BENJAMIN F. RAY,
(Term Expires Sept. 6th, 1903.

Officers and Employees.

Supt. & Secy.,.....E. L DUNBAR.
Office Assistant,.....T. A. DELZELL.
Inspector,.....F. H. COLLINS.
Reservoir Keeper,.....L. D. CARPENTER.
First Engineer,.....A. B. VERITY.
Second Engineer,.....JAS. E. DARLING.
Fireman, ...JAS. H. McGIBBONS.
Fireman, ...PATRICK O'HARE.
Turn-Key,.....THOMAS LARDNER.

Superintendent's Report.

To the Honorable Board of Commissioners of Water Works, of Bay City, Michigan.

Gentlemen:—I respectfully report the operations of the water department for the year ending December 31st, 1896, as follows:

The quantity of water pumped during the year has been reduced from 1,122,363,460 gallons in 1895, to 1,009,523,471 gallons in 1896, a decrease of 112,839,989 gallons, or a fraction more than 10 per cent. This decrease is without doubt mainly due to the abandonment of the old main in Water and Harrison streets, from 23rd street to South Center street, and the cutting off of undiscovered leakage from that pipe.

The receipts of the department have increased slightly, having been $22,820.30 in 1895, and $23,223.96 in 1896. The increase in receipts from water rates was from $22,406.31 in 1895, to $23,064 86 in 1896, or $658.55. This is the first year since 1891 that the receipts of the department have shown an increase over those of the last preceeding year.

The expenditures of the department for maintenance and repairs have been $18,731.58, which is about $6,000 more than the ordinary operating expenses.

The breakwaters protecting the inlet cut at the Bay were extended about 1,300 feet, at a cost of nearly $4,000.00, and about $350.00 were expended in completing the grading and seeding of the banks of the basin, and grading the banks of the inlet cut.

The brick walls of the pumping station were repaired and painted at a cost of about $400 00; and the building protected from the dangerous fire hazard to which it was exposed by replacing the wooden ventilators in the roof with iron, placing iron shutters on the

windows on the west side of the building, and placing two monitor nozzles on the pumping station grounds between the building and the lumber yard of Eddy, Sheldon & Company, the total outlay for this protection from fire being about $850.00.

The inlet wells at the pumping station have been partially rebuilt and placed in thoroughly good repair, and a cut stone coping has been placed on the walls, the total cost being about $300.00.

Much of the above work is a permanent improvement and might properly be classed with construction, but it has been carried under the head of repairs.

The expenditures charged to construction accounts have been $3,849.51.

A 30 inch pipe was laid from the river to the inlet wells, (in place of the 18 inch pipe laid in 1872,) at a cost of $1,580.47.

The main distribution system has been extended 2,550 feet at a cost of $1,786.05.

The length of old main pipes discontinued was 6,849½ feet, making a net decrease in the distributing system of 4,299½ feet.

The meter system has been extended by a net increase of 61 meters in service, with an outlay for this branch of the service of $482.99.

The necessary work for the coming year includes the extension of the breakwater along the inlet cut at the Bay about 1,000 feet, which will take them as far out as it is advisable to extend the works in this manner. If water is taken from farther out in the Bay, it will be necessary to bring it in through a pipe. The expense of laying a pipe to a point in the Bay where there is sufficient depth of water to properly protect the intake will be so large as to require an appropriation for the purpose, and no such extension is advised until the matter of changing the source of supply to the west shore of the Bay in the near future is decided. That the water supply of the city will, at some time, be brought from a point in the Bay west of the mouth of Saginaw river is beyond question, and in view of this fact, no more money should be expended on the present inlet works than is necessary to properly protect the works, and maintain the supply so as to avoid the use of water from the river to as great

an extent as possible. The past year has marked a very preceptible rise in the level of the water in the Bay, which, together with the improvements made to the inlet works at the Bay have materially reduced the use of the supply from the river. During the year 1895, the river supply was in use, either wholly or partially a total of about 34 days, while in 1896 it was in use a little more than 4 days.



FINANCIAL.

RECEIPTS.

The receipts of the department for the year have been:

From water rates, roll of 1886	$ 2 09	
From water rates, roll of 1887	1 00	
From water rates, roll of 1890	3 92	
From water rates, roll of 1891	2 00	
From water rates, roll of 1892	9 38	
From water rates, roll of 1893	20 50	
From water rates, roll of 1894	43 25	
From water rates, roll of 1895	802 93	
From water rates, roll of 1896	22,179 88	
Total from water rates		$23,064
From Plumbers licenses,	$ 20 00	
" Services connections	128 50	
" Sale of cast iron pipe	10 60	
Total miscellaneous,		15[illegible]
Total receipts		$23,22[illegible]

These receipts have been deposited with the City Treasurer as per receipts on file, as follows:

January 31, 1896	$1,641 05
February 29, "	564 90
March 31, "	1,147 62
April 30, "	1,134 23
May 30 "	1,153 26
June 30 "	1,934 78
July 31, "	2,066 76
August 31, "	1,581 43
September 30, "	1,829 43
October 31, "	2,057 03
November 30, "	1,090 75
December 31, "	7,022 72
	$23,22[illegible]

EXPENDITURES.

The expenditures of the department for the year were as follows:

FOR MAINTENANCE ACCOUNT.

Office department:

Supt. and Secy's salary	$ 1,800 00
Office assistant	800 00
Office expenses	460 [illegible]

Street and service department:		
Repairs on main distribution	589 73	
Repairs on services and turning on and off	394 53	
Repairs and care of water meters	672 92	
Repairs and care of inlet works	4,876 50	
Service connections	43 79	
Pumping department:		
Salaries of engineers and firemen	3,644 65	
Fuel	3,063 71	
Oil, packing and supplies	448 65	
Repairs on engines and boilers	275 04	
Repairs to buildings, etc.		
Repairs to engine house and grounds	1,358 58	
Repairs to wells	302 87	
Total for maintenance account		$18,731 58

FOR CONSTRUCTION ACCOUNT.

Water Meter account:		
New meters	$ 471 14	
Setting Meters	11 85	
Main Distribution:		
Cast iron pipe	$ 999 70	
Valves	136 87	
Fire Hydrants	151 95	
Laying pipe	497 53	
Inlet from Saginaw river	1,580 47	
Total for Construction		$3,849 51
Total expenditures		$22,581 09

The City Treasurer has paid from money raised by tax levy the annual interest on outstanding Water Works Bonds amounting to $26,110.00. Series No. 10, issued January 15th, 1872, and Series No. 30, issued October 15th, 1874, of the Bonds issued for the construction of Water Works, amounting to $20,000.00, fell due October 15th, 1896, and were paid from the proceeds of $20,000.00 Refunding Bonds issued October 1st, 1896, payable October 1st, 1921. The refunding bonds bear interest at the rate of 4 per cent. per annum.

The total amount of interest paid to date on Water Works Bonds issued for the construction of Water Works is $685,785.00, all of which has been paid by tax levy.

The total amount of Bonds issued for the construction of Water

Works, was $452,000.00, of which $90.000 00 has been paid by tax levy, leaving $362,000.00 outstanding.

Of the Bonds issued for the construction of Water Works, $377,000.00 issued in 1871, 1872, 1873, 1874 and 1875 bore interest at the rate of 8 per cent. per annum. $90,000.00 of these Bonds have been paid, and $40,000.00 redeemed by the issue of Refunding Bonds, leaving amount of 8 per cent. Bonds outstanding $247,000.00 The Refunding Bonds bear interest at the rate of 4 per cent. per annum. $75,000.00 of Bonds issued May 1st, 1891, bear interest at the rate of 5 per cent. per annum.

The total net cost of construction to date is $566,724.16.
Total amount paid for maintenance and repairs to December 31st, 1896, is $283,539.92.

Bonds Outstanding December 31st, 1896.

Series.	Date of Issue.	Date Payable.	Amount.	Rate of Interest.
No. 11	January 15, 1872	October 15, 1897	$10,000 00	8 per cent.
" 12	" " "	" " 1898	8,000 00	"
" 13	August 15, 1872	February 16, 1899	10,000 00	"
" 14	" " "	" " 1900	10,000 00	"
" 15	" " "	" " 1901	10,000 00	"
" 16	" " "	" " 1902	10,000 00	"
" 17	" " "	" " 1903	10,000 00	"
" 18	" " "	" " 1904	9,000 00	"
" 19	August 15, 1873	" " 1905	10,000 00	"
" 20	" " "	" " 1906	10,000 00	"
" 21	" " "	" " 1907	10,000 00	"
" 22	" " "	" " 1908	10,000 00	"
" 23	" " "	" " 1909	10,000 00	"
" 24	February 15, 1874	" " 1910	10,000 00	"
" 25	April 15, 1874	April 15, 1911	10,000 00	"
" 26	" " "	" " 1912	10,000 00	"
" 27	" " "	" " 1913	20,000 00	"
" 31	October 15, 1874	October 15, 1897	10,000 00	"
" 32	" " "	" " 1898	10,000 00	"
" 33	March 1, 1875	March 1, 1900	10,000 00	"
" 34	" " "	" " 1901	10,000 00	"
" 35	June 1, 1875	June 1, 1902	10,000 00	"
" 36	" " "	" " 1903	10,000 00	"
" 37	" " "	" " 1904	10,000 00	"
Not Seried :				
Nos. 1 to 25	May 1, 1891	May 1, 1906	25,000 00	5 per cent.
" 26 to 50	" " "	" " 1911	25,000 00	"
" 51 to 63	" " "	" " 1917	12,500 00	"
" 64 to 76	" " "	" " 1918	12,500 00	"
Refunding:				
Nos. 1 to 20	October 1, 1895	October 1, 1920	20,000 00	4 per cent.
" 1 to 20	October 1, 1896	" " 1921	20,000 00	"
			$362,000 00	

Account with Water Works Fund and City Treasurer.

The cash collections of the office, amounting to $23,223.96 have been deposited in the City Treasury and charged to the Water Works Fund.

Statements of claims against the Board have been filed with the City Recorder, who has issued his warrant, payable from the Water Works Fund, for the amount of these claims, as follows:

January 31, 1896,	Warrant	No.	323	$2,451 09	
February 28, "	"	"	324	2,524 47	
March 31, "	"	"	325	1,398 27	
April 30, "	"	"	326	983 51	
May 29, "	"	"	327	1,446 94	
June 30, "	"	"	328	2,700 24	
July 31, "	"	"	329	1,667 25	
August 31, "	"	"	330	1,785 64	
September 30 "	"	"	331	3,890 01	
October 31, "	"	"	332	1,364 42	
November 30, "	"	"	333	1,054 01	
December 31, "	"	"	334	1,315 24	
					$22,581 09

Water Works Fund:

	Dr.	Cr.
Balance in Fund, January 1, 1896,	$ 9,506 74	
Collections deposited in fund,	23,223 96	
Amounts withdrawn from Fund on Recorder's Warrants 323 to 334		$22,581 09
Balance in Fund, December 31, 1896		10,149 61
	$32,730 70	$32,730 70

The City Treasurer acting as treasurer of the Board of Water Works has been charged with the Recorder's warrants as they were deposited with the said treasurer, amounting to $22,581.09, and the secretary of this board has drawn orders on the said treasurer in favor of the several persons mentioned in the statements filed with the city Recorder for an equal amount.

City Treasurer as Treasurer of Board:	Dr.	Cr.
To Recorder's Warrants, Nos. 323 to 334 inclusive	$22,581 09	
By Paid Secretary's Orders, No. 3,510 to 3,909 inclusive,		$22,581 09
	$22,581 09	$22,581 09

Bay City Water Works—Balance Sheet for 1896.

LEDGER E.

Folio 133,	Water rates, Roll of 1896		$22,17[illegible]
" 135,	Water rates, Roll of 1895		[illegible]
" 136,	Water rates, Roll of 1894		[illegible]
" 136,	Water rates, Roll of 1893		[illegible]
" 137,	Water rates, Roll of 1892		[illegible]
" 137,	Water rates, Roll of 1891		[illegible]
" 137,	Water rates, Roll of 1890		[illegible]
" 136,	Water rates, Roll of 1887		[illegible]
" 136,	Water rates, Roll of 1886		[illegible]
" 138,	Plumbers Licenses,		[illegible]
" 147,	Service connections,		[illegible]
" 140,	City Water Works Fund,	$ 642 87	
" 141,	Office Department, salaries,	2,600 00	
" 155,	Office Department, expenses,	460 61	
" 155,	Street and service dep't, repairs on main distribution	589 73	
" 144,	Street and service dep't, repairs and care of services	394 53	
" 145,	Street and service dep't, repairs and care of water meters	672 92	
" 154,	Street and service dep't, repair and care of inlet works	4,876 50	
" 148,	Pumping department, salaries	3,644 65	
" 149,	Pumping department, fuel	3,063 71	
" 153,	Pumping department, oil, packing and supplies	448 65	
" 151,	Pumping department, repairs on engines and boilers	275 04	
" 152,	Repairs to engine house and grounds	1,358 58	
" 153,	Repairs to wells	392 87	
" 156,	Water meters—new meters	471 14	
" 157,	Water meters—setting meters	11 85	
" 158,	Main distribution, cast iron pipe	989 10	
" 159,	Main distribution, valves	136 87	
" 160,	Main distribution, fire hydrants	151 95	
" 161,	Main distribution, laying pipe	497 53	
" 162,	Inlet from Saginaw river	1,580 47	
		$23,169 57	$23,1[illegible]

Ledger Balances, December 31, 1896.

LEDGER E.

Folio 1,	Bay City Bond account, ($452,000 Bonds)		$443,0[illegible]
" 1,	Water Assessment, frontage on pipe		[illegible]
" 24,	Water Rates		[illegible]
" 22,	Plumber's Licenses		[illegible]
" 21,	Services taps and stop boxes		[illegible]
" 21,	Rents, Dockage, &c.,		[illegible]
Folio 2,	Construction—real estate	$ 6,724 83	
" 2, "	dock, tramway and store shed	1,882 63	
" 3, "	engine house, chimney and wells	21,401 42	
" 3, "	engine foundations, boiler foundations and arches	6,777 45	
" 4, "	pumping machinery	59,427 72	

Folio 4,	Construction—	inlet from Saginaw River,	4,799 46	
" 5,	"	inlet from Saginaw Bay,	84,778 37	
" 5,	"	reservoir breakwater, &c.,	24,713 78	
" 6,	"	iron pipe and branch casting,	107,799 05	
" 6,	"	Wyckoff patent pipe,	126,441 31	
" 7,	"	valves for street mains,	15,876 47	
" 7,	"	public fire hydrants,	15,072 45	
" 8,	"	laying pipe,	58,852 10	
" 8,	"	building at bay	452 46	
" 9,	"	water meters,	16,604 46	
" 9,	"	furniture and fixtures,	990 96	
" 10,	"	implements,	1,713 61	
" 10,	"	engineering and general superintendance,	7,856 17	
" 11,	"	traveling expenses,	306 29	
" 11,	"	insurance	29 00	
" 12,	"	interest, discount and commissions,	4,224 17	
" 13,	Maintenance—	Office expenses and salaries,	57,345 93	
" 13,	"	repairs and care of hydrants, valves and pipes,	17,514 13	
" 14,	"	repair and care of water meters,	4,721 48	
" 14,	"	repairs and care of inlet works, &c.,	29,691 24	
" 15,	"	repairs to engine house, &c.,	3,051 51	
" 15,	"	repairs to dock,	13 38	
" 16,	"	engineers and firemens wages,	84,769 81	
" 16,	"	fuel,	64,528 01	
" 17,	"	oil, packing and supplies,	9,121 53	
" 17,	"	repairs to pumping machinery,	6,665 14	
" 18,	"	repairs to engine foundations,	51 46	
" 18,	"	repairs to boiler arches,	1,183 30	
" 19,	"	implements,	1,129 37	
" 19,	"	interest,	3,709 84	
Folio 20,	City Water Works Fund,		10,149 61	
			$860,369 90	$860,369 90

Water Rates.

The total amount charged on the assessment roll of 1896 was:

For water supplied at fixed rates,	$11,478 13	
For water supplied through meters,	11,956 00	
		$23,434 13

The amounts collected were:

From fixed rates,	$10,963 19	
From metered water,	11,216 69	
		$22,179 88

Amounts uncollected:

From fixed rates,	$514 94	
From metered water,	739 31	
		$1,254 25

The amounts collected on rolls of previous years were:

From fixed rates,	$218 05	
From metered water,	666 93	
		$884 [illegible]

The amount collected for water:

Supplied for domestic purposes was,	$17,322 [illegible]
For manufacturing purposes,	5,741 [illegible]
	$23,064 [illegible]
From fixed rates, domestic,	[illegible]
From metered water, domestic	[illegible]
From fixed rates, manufacturing,	534 [illegible]
From metered water, manufacturing,	5,207 [illegible]
	$23,064 [illegible]

The quantity of water supplied through meters was, 106,740,243 gallons, of which 53,762,412 gallons were furnished for manufacturing purposes, for which there was collected $4,754.36: uncollected at the end of the year $394.26, making total amount charged on the roll for water supplied through meters for manufacturing purposes $5,148.62. 52,997,831 gallons were supplied through meters for domestic purposes for which the amount charged on the roll was $6,807 38 of which $6,462 33 was collected, and $345.05 was uncollected at the close of the year.

The total amount collected and uncollected on each year's roll since the works commenced operations has been as follows:

YEAR.	COLLECTED.	UNCOLLECTED.	TOTAL ON ROLL
1873 January 1st to April 30th	$ 728 82		$ 728 82
1873-4 May 1st, 1873 to April 30th, 1874	5,440 80	$ 1 60	5,442 40
1874-5 May 1st, 1874 to April 30th, 1875	6,908 16	44 85	6,953 01
1875 May 1st to December 31st	7,269 55	28 46	7,298 01
1876	9,571 26	82 73	9,653 99
1877	9,604 26	134 19	9,738 45
1878	10,078 15	324 71	10,402 86
1879	11,708 97	136 07	11,845 04
1880	13,155 74	120 25	13,275 99
1881	15,002 61	212 40	15,215 01
1882	17,352 47	158 85	17,511 32
1883	18,713 46	98 64	18,812 10
1884	18,892 02	129 89	19,021 91
1885	19,716 73	269 58	19,986 31
1886	19,350 61	124 74	19,475 35
1887	19,436 25	87 00	19,523 25
1888	21,278 62	120 80	21,399 42
1889	22,120 47	113 03	22,233 50
1890	23,297 81	202 81	23,500 62
1891	24,619 51	286 35	24,905 86
1892	24,185 81	280 32	24,466 13
1893	23,609 41	550 72	24,160 13
1894	22,780 40	587 11	23,367 51
1895	22,888 90	343 77	23,232 67
1896	22,179 88	1,254 25	23,434 13
Totals,	$409,890 67	$5,693 12	$415,583 79

Main Distribution.

The amount expended on account of the extension of the main distribution system was:

For cast iron pipe and special castings,	$ 999 70
For valves and valve boxes,	136 87
For fire hydrants,	151 95
For laying pipe,	497 53
	$1,786 05

The cost of each of the several lines of pipe laid was:

Madison Avenue from Sherman to Sheridan Street,	$ 210 95
Sheridan Street from Madison Ave. to Woodside Ave.,	707 53
Birney Street from Second Street to Third Street,	229 47
Third Street from Birney Street to Johnson Street,	460 93
Water Street and Harrison Street from 23rd Street to South Center St. (connecting old services to new main)	79 57
Value of pipe left in stock from years purchase	97 60
	$1,786 05

The length of pipe laid during the year was:

10 inch cast iron,	2½ feet.
6 inch cast iron,	2,509½ feet.
4 inch cast iron,	42 feet.
	2,554 feet.

The length of pipe discontinued was:

	10 inch.	8 inch.	6 inch.	4 inch.	TOTAL.
Cast Iron	68½	28½	36	14	147 ft.
Wyckoff	3,686½	1,812½	985½	199	6,683½ ft.
Total,	3,755	1,841	1,021½	213	6,830½ ft.

Total length of main pipe in service December 31st, 1896:

	Cast Iron.	Wyckoff.	Total.
20 inch	9,563 ft.		9,563 ft.
16 inch	13,778 "		13,778 "
12 inch	9,083 "		9,083 "
10 inch	11,102 "	28,039 ft.	39,141 "
8 inch	5,186 "	25,226¼ "	30,412¼ "
6 inch	12,701½ "	90,300 "	103,001½ "
4 inch	1,410¼ "	21,601¼ "	23,011½ "
3 inch		319 "	319 "
Total	62,823¼ ft.	165,485½ ft.	228,309¼ ft.

Total cast iron mains,	11 miles,	4,743½ feet.
Total Wyckoff mains,	31 "	1,805½ "
Total mains,	43 miles,	1,249½ feet.

Percentage of each size of pipe:

20 inch,	4.19 per cent.
16 "	6.00 "
12 "	3.98 "
10 "	17.15 "
8 "	13.33 "
6 "	45.12 "
4 "	10.09 "
3 "	.14 "
	100.00

The number of valves set in distributing mains was 11:

6 inch Eddy pattern,	5
4 inch Eddy pattern,	6
	11

And the number of valves discontinued was:

10 inch Flower pattern,	2
8 inch Flower pattern,	1
4 inch Flower pattern,	14
3 inch Flower pattern,	2
	19

Number of valves in service December 31, 1896:

	20 in.	16 in.	12 in.	10 in.	8 in.	6 in.	4 in.	3 in.	Total
Flower Patent.	4	9	3	35	43	163	336	3	596
Galvin Patent.			2		1	5	45		53
Brown Patent.			1			1			2
Eddy Patent.						5	6		11
Total	4	9	6	35	44	174	387	3	662

Blow off gates included in above:

Three	6 inch.
Fifteen	4 inch.
Two	3 inch.

Of the valves discontinued, one 4 inch and two 3 inch have been taken out, the others will be taken out during the coming season.

The number of fire hydrants set during the year was six, all Matthews pattern double discharge, located as follows:

N. E. corner Madison Avenue and Sheridan Street.

N. E. corner Sheridan and Fitzgerald Streets.

N. E. corner Sheridan and Barney Streets.

N. E. corner Sheridan and Ketchum Streets.

N. E. corner Birney and Third Streets.

N. side Third St., between McLellan and Hampton Streets.

Whole number of fire hydrants in service, December 31st, 1896, 393. of the following described patterns:

Matthews, 6 inch inlet, 3 hose nozzles, gated	32
Matthews, 4 inch inlet, 2 hose nozzles,	190
Bourbon, 6 inch inlet, 3 hose nozzles, gated,	5
Bourbon, 4 inch inlet, 2 hose nozzles,	10
Holly, 4 inch inlet, 2 hose nozzles, gated,	4
Holly, 4 inch inlet, 2 hose nozzles,	129
Gaskell, 4 inch inlet, 2 hose nozzles,	15
Gaskell improved, 4 inch inlet, 2 hose nozzles,	1
Galvin, 4 inch inlet, 2 hose nozzles	5
Morgan, 4 inch inlet, 2 hose nozzles,	1
Brown, 4 inch inlet, 2 hose nozzles,	1
	393

Water Meters.

The amount expended during the year for the extension of the meter system was $482.99 as follows:

For 49 new meters,	$471 14
For fittings, &c., setting meters,	11 85
	$482 99

The number of meters set during the year was 69, of which 5 were to replace meters taken out.

The number of meters taken out was 8, of which 5 were replaced by other meters and three permanently removed. One of the meters removed was a test meter the further use of which seemed unnecessary; the other two were attached to services from which the use of water has been permanently discontinued.

The whole number of meters in service December 31st, 1896, is 620.

The number of meters permanently removed to date 99, besides 2 elevator or motor indicators abandoned.

Total cost of meter system to date $16,604.46.

Cost of 620 meters in service,	$14,523 28
Cost of 46 meters in stock,	1,192 21
Cost of meter fittings in stock,	70 29
Amount expended on 99 meters and 2 indicators taken out	818 68
	$16,604 46

The two motor indicators were discontinued by reason of their indications not being reliable, and meters were placed in the supply pipes.

Of the 99 meters permanently discontinued, 23 were test meters, the further use of which was deemed not necessary; 23 were for supplying premises from which the buildings have been burned or removed, with no probability of their being rebuilt; 16 were for supplies to premises now supplied through new services; 9 were meters set for measuring water used for building purposes and removed upon the completion of the buildings; 4 were on services through which water has since been supplied at schedule rates, and 24 were on services through which no water has been used for several years, and the use of water through them has been apparently permanently discontinued.

Water meters set in 1896:

	2 in.	1 in.	¾ in.	⅝ in.	½ in.	⅜ in.	Total.
Union Rotary,	1			2			3
Union Duplex				2			2
Columbia				5			5
Crown,		2	2		2	2	8
Empire,					1		1
Empire, A A.				5			5
Nash				6			6
Hersey				1			1
Hersey Disc				6			6
Thomson				3			3
Thomson Bee				6	2		8
Lambert				6			6
Trident				13			13
Westinghouse				2			2
Total,	1	2	2	57	5	2	69

Meters taken out in 1896:

	1 in.	1 in.	¾ in.	⅝ in.	½ in.	Total.
Crown,					1	1
Empire,		1	1		2	4
Worthington,	1					1
Thompson,				1		1
Thompson Bee,					1	1
Total,	1	1	1	1	4	8

Meters in service December 31st, 1896:

	8 in.	4 in.	3 in.	2 in.	1½ in	1 in.	¾ in.	⅝ in.	½ in.	⅜ in.	Total.
Union Rotary	1	6	17	6	3	3	.....	42	.....	.....	78
Union Duplex	.....	.....	.....	.....	.....	.....	.....	19	.....	.....	19
Columbia	.....	.....	.....	.....	.....	.....	.....	5	.....	.....	5
Crown	.....	.....	.....	.....	1	22	33	.....	26	42	124
Empire	.....	.....	.....	.....	.....	3	30	.....	19	.....	52
Empire A. A	.....	.....	.....	.....	.....	.....	.....	5	.....	.....	5
Nash	.....	.....	.....	.....	.....	.....	.....	20	.....	.....	20
Gem	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	1
Worthington	.....	.....	.....	7	4	.....	.....	16	.....	.....	27
Hersey	.....	.....	.....	.....	.....	2	5	25	.....	.....	32
Hersey Disc	.....	.....	.....	.....	.....	.....	.....	17	.....	.....	17
Thomson	.....	.....	.....	.....	.....	2	1	101	.....	.....	104
Thomson Bee	.....	.....	.....	.....	.....	.....	.....	18	72	.....	90
Lambert	.....	.....	.....	.....	.....	.....	.....	6	.....	.....	6
Trident	.....	.....	.....	.....	.....	.....	.....	37	.....	.....	37
Westinghouse	.....	.....	.....	.....	.....	.....	.....	3	.....	.....	3
Total,	1	6	17	14	8	32	69	314	117	42	620

Meters in stock December 31st, 1896:

	3 in.	1½ in	1 in.	¾ in.	⅝ in.	½ in.	Total.
Union Rotary,	4	1	.....	1	.....	.....	6
Union Duplex	.....	.....	.....	.....	3	.....	3
Crown,	.....	.....	3	1	.....	2	6
Empire,	.....	.....	3	5	.....	6	14
Worthington,	.....	2	.....	.....	.....	.....	2
Hersey,	.....	.....	.....	.....	1	.....	1
Hersey Disc,	.....	.....	.....	.....	4	.....	4
Thomson	.....	.....	.....	1	1	.....	2
Trident,	.....	.....	.....	.....	5	.....	5
Westinghouse,	.....	.....	.....	.....	3	.....	3
Total,	4	3	6	8	17	8	46

Inlet Works.

Since the Gaskill pumping engine was placed in service the 18 inch pipe from the river to the pumping station has not been of sufficient capacity to supply all of the pumping engines to their full capacity, in case of accident to the pipe from the bay, or if from any cause no water could be introduced from that source.

To insure a full supply to the pumps under all probable contingencies this 18 inch pipe was removed and a 30 inch pipe laid in its place. The openings in the front of the inlet crib at the river were lowered about two feet to guard against a failure in the supply from low water, and with the completion of some proposed improvements to the approach to the inlet crib a full supply to the capacity of the pumping engines will be as fully guaranteed as is possible under existing circumstances.

The total cost of this improvement was as follows:

384½ feet 30 inch stave pipe @ $2.50	$ 961 25
Iron pipe and gate at crib,	138 16
Laying pipe and connecting at crib and wells,	481 06
	$1,580 47

The inlet works at the bay have been improved by extending the breakwaters along the banks of the inlet cut about 1,300 feet. The banks of the inlet basin, and a portion of the inlet cut graded and sown with grass seed, and some additional work done on clearing a channel in the cut across the bar at the outer end of cut. The cost of these extensions and improvements has been as follows:

Extension of breakwaters,	$3,840 73
Grading and seeding banks,	358 93
Cleaning sand and ice in cut,	73 49
Tools and repairing tools,	64 45
	$4,337 60

During the summer it was discovered that there was some leakage of surface water into the inlet pipe at some point between the bay and the pumping station. A careful examination located one point where such leakage occurred, about one and one-half miles from the end of the pipe. It was found that one of the upper staves in two sections of pipe had settled out of place leaving a small opening into the pipe where the end of the staves abutted together. The staves were brought back to place and properly secured, and the joints thoroughly caulked. There has been no more trouble at this point, but there is still some leakage into the pipe, the location of which it has been as yet impossible to determine.

The cost of the repairs and care of inlet works aside from the extension and improvements itemized above has been as follows:

Salary of reservoir keeper,	$420 00
Officer assisting reservoir keeper,	20 00
Repairing inlet pipe from bay,	25 38
Repairs to inlet crib at river and pumps,	73 52
	$538 90

Pumping Station.

In November, 1895, serious complaint was made of the danger to which the pumping station was exposed by reason of the large quantity of lumber in the yard of The Eddy-Sheldon Company, adjoining the pumping station grounds on the west side. It was claimed by some of the insurance companies that in case of a conflagration in the lumber yards mentioned, with the wind blowing from a westerly direction, the pumping station would probably be destroyed or the machinery disabled, and the attempt was made to compel the erection of brick fire walls on the west and north sides of the engine house between the building and the lumber yard. The erection of such a fire wall was not favored by the board, but iron shutters were placed on the windows on the west side of the building, the wooden ventilators in the roof were replaced with iron, and two Monitor nozzles were placed, one near the southwest angle, and one near the northwest angle of the station. The store shed, at that time located between station and lumber yard, has also been removed to a point north of the pumping station and about 100 feet farther away from the lumber. As the pumping station is a substantial brick structure with slate roof, it is as safe from destruction by fire as it is possible to make it without removing to a greater distance from the surrounding risk.

The cost of this fire protection was:

For moving store shed,	$ 23 50
For iron ventilators and shutters,	184 90
For two Monitor nozzles and setting,	655 16
	$863 56

The brick walls of the engine house, after 25 years of exposure to the elements were beginning to show signs of disintegration. They have been repaired by the removal of all defective brick, and replacing them with sound ones, and the building and smoke stack were given three coats of paint.

The Michigan Central Railroad Company have built a side track for the delivery of coal direct from cars to the coal house, and it has been necessary to put in crossings, and build a platform along the north side of the coal sheds.

The sewer from the pumping station to the river has been relaid, improving the grade, and replacing defective pipe.

The roof of the pumping station has been placed in good repair and a little work has been done towards grading and improving the pumping station grounds.

The north wall of the suction well has been decaying for several years, and it became necessary to tear away a portion of this wall and rebuild it, and the tops of all of the walls covered with a substantial cut stone coping.

The cost of these several repairs to pumping station, wells and grounds has been as follows:

For repairing and painting brick walls of pumping station,	$400 21
For repairing roof,	10 61
For track crossings and platform,	28 95
For relaying sewer,	34 25
For grading grounds,	21 00
For repairing wells, and stone coping,	302 87
	$797 89

WATER PUMPED AND COST OF PUMPING.

The total quantity of water pumped during the year was 1,009,523,471 gallons, of which 991,189,882 gallons were pumped against a domestic pressure of 40 pounds per square inch, and 18,333,589 gallons were pumped against an average fire pressure of 73 16-100 pounds per square inch. The average lift from the surface of the water in the suction wells for all of the water pumped was 113 feet.

The right Gaskill engine and pumps were run 8,520 57-60 hours, and the left Gaskill engine and pumps 8,704 57-60 hours. The quantity of water pumped by the Gaskill engines was 997,321,385 gallons.

The Quadruplex engines were run 115 58-60 hours, and pumped 11,924,935 gallons.

The High pressure engine and Rotary pumps were run 3 22-60 hours pumping 277,151 gallons.

The number of fire alarms received at the pumping station was 157, and the number of hours the works were run under fire pressure was 94 35-60.

Two serious breaks occurred on the Gaskill engines, but prompt action on the part of the engineer prevented any injury outside of the actual breakage.

The fork end of the connection rod on the right Gaskill engine was broken at the same point that the rod on the other side of this engine was broken just one year before. The three bolts holding the upper end of cap to the beam shaft bearing on one side of the left Gaskill engine were broken.

The total amount expended for operating the pumping engines was:

Salaries of regular engineers and firemen,	$3,620 00
Extra firemen,	24 65
Fuel,	3,063 71
Oil, packing, and engineers supplies,	448 65
Repairs on engines and boilers,	275 04
	$7,432 05

The net cost of operating the pumping engines was:

Engineers and firemen,	$3,644 65
Fuel consumed,	3,058 58
Oil, packing, &c. used	378 44
Repairs,	275 04
	$7,356 71

The cost of pumping based on total pumping station expenses, $7,356.71, was:

Per million gallons pumped,	$7 29
Per million gallons raised 100 feet,	6 45

The cost of fuel was:

Per million gallons pumped,	$3 03
Per million gallons raised 100 feet,	2 68

The fuel used during the year was principally coarse slack, the first part of the year from Ohio mines, and later from the Monitor mines in this county. The coal from our home mines is giving us excellent service, and is proving to be well adapted to use for steam purposes.

Fuel on hand January 1st, 1896.

91 cords wood cost	$ 91 00
10 500-2000 tons lump coal cost	27 16
30 300-2000 tons slack coal	60 30
	$178 46

Fuel purchased during the year 1896:

50 cords of wood cost	$ 25 00
Paid for moving wood on yard	23 25
415 1370-2000 tons Ohio slack cost	831 37
1,029 100-2000 tons Monitor slack cost	1,796 40
26 1400-2000 tons Ohio lump cost	69 42
141 1100-2000 tons Monitor lump cost	318 27
	$3,063 71

Fuel burned in 1896:

94 cords wood cost	$ 115 75
151 1485-2000 tons lump coal cost	345 82
1,422 497-2000 tons slack coal cost	2,597 01
	$3,058 58

Fuel on hand December 31st, 1896:

47 cords wood cost	$ 23 50
26 1515-2000 tons Monitor lump coal cost	69 03
52 1273-2000 tons Monitor slack coal cost	91 06
	$183 59

The pumping plant consists of:

BOILERS.

Five in number, all horizontal return tubular boilers set in separate brick arches. Three boilers are 16 feet long, 66 inches in diameter, with 105 tubes 16 feet long and 2¾ inches interior diameter in each boiler. Two boilers are 16 feet long, 60 inches in diameter, with 48 tubes 16 feet long and 3¾ inches in diameter in each boiler. The area of grate surface under each boiler is as follows: No. 1, 27½ square feet; Nos. 2 and 3, each 34 square feet; Nos. 4 and 5, each 22½ square feet.

Heating surface: Nos. 1, 2 and 3, each (½ shell 138.24 square feet, entire tubes 1209.51 square feet) 1347.75 square feet. Nos. 4 and 5 each (½ shell 125.66 square feet, entire tubes 753.98 square feet) 879.64 square feet.

ENGINES AND PUMPS.

One Gaskill horizontal compound condensing crank, and fly wheel pumping engine, maximum capacity 5,000,000 gallons in 24 hours.

One Holly Quadruplex compound condensing crank and fly wheel pumping engine, maximum capacity, 3,000,000 gallons in 24 hours.

One horizontal high pressure piston engine driving through gear, two No. 10 Holly rotary pumps, maximum capacity 2,500,000 gallons in 24 hours.

Capacity of Gaskill pumps per revolution 121 gallons.

Capacity of Quadruplex pumps per revolution 55 gallons.

Capacity of Rotary pumps (2) per revolution 17 gallons.

The total quantity of water pumped each year since the works commenced operations has been as follows:

1873	142,477,725 Gallons	1885	836,970,046 Gallons
1874	294,714,798 "	1886	779,761,852 "
1875	416,756,579 "	1887	827,195,009 "
1876	518,197,129 "	1888	872,990,164 "
1877	538,847,186 "	1889	944,472,747 "
1878	530,197,397 "	1890	988,771,453 "
1879	672,344,128 "	1891	1,014,475,024 "
1880	827,067,372 "	1892	962,953,662 "
1881	944,382,043 "	1893	1,044,256,236 "
1882	775,642,466 "	1894	1,024,735,621 "
1883	773,942,702 "	1895	1,122,363,460 "
1884	831,867,463 "	1896	1,009,523,471 "

WATER PUMPED 1896.

Month.	Gaskill Engine.			Quadruplex Engines			Rotary Pumps.			Totals.		Fire Alarms.					
	Hours Run.	Revolutions.	Gallons Pumped.	Hours Run.	Revolutions.	Gallons Pumped.	Hours Run.	Revolutions.	Gallons Pumped.	Gallons Pumped.	Daily Average.	No. Alarms.	Hours Run.	Highest Pressure	Lowest Pressure	Average Pressure	Gallons Pumped.
January...	744	718,170	86,898,570	.....	.....	.....	.....	.....	.....	86,898,570	2,803,180	9	3:21	70	70	70	564,102
February..	692;30	656,424	79,427,304	3:30	9,873	543,015	.....	.....	.....	79,970,319	2,757,597	6	2:19	70	70	70	394,097
March.....	742:40	717,744	86,847,024	1:20	4,193	230,615	.....	.....	.....	87,077,639	2,808,956	14	7:57	70	70	70	1,368,873
April.....	716:00	708,574	73,869,774	4:38	12,722	699,710	.....	.....	.....	74,569,484	2,485,649	11	4:13	70	70	70	671,846
May.	737:00	659,200	75,660,029	7:25	18,351	1,009,305	.....	.....	.....	76,669,334	2,473,204	10	10:29	70	70	70	1,814,147
June.....	720:00	769,988	93,168,548	:50	1,750	96,250	2:35	13,854	235,518	93,500,316	3,116,677	21	12:04	90	70	74.4	2,651,096
July.....	740:30	894,306	98,266,883	71:40	119,037	6,068,260	:47	2,449	41,633	104,376,776	3,366,993	19	6:21	80	70	72.4	1,455,188
August....	744:00	695,806	84,192,526	.....	.....	.....	.....	.....	.....	84,192,526	2,715,888	10	5:07	70	70	70	914,397
September	718:07	669,284	80,983,364	6:30	13,601	748,055	.....	.....	.....	81,731,419	2,724,381	13	8:36	80	70	77.7	2,063,226
October....	737:50	665,906	80,208,359	6:10	13,413	737,715	.....	....	.....	80,946,074	2,611,164	22	14:16	70	70	70	2,126,396
November.	714:50	633,166	76,613,086	5:10	14,073	774,015	.....	.....	.....	77,387,101	2,579,570	8	3:46	70	60	67.5	580,415
December..	742:30	670,958	81,185,918	8:45	18,509	1,017,995	.....	.....	.....	82,203,913	2,651,739	14	16:06	80	70	77.6	3,729,80[illegible]
Totals...	8,749:57	8,459,536	997,321,385	115:58	225,522	11,924,935	3:22	16,303	277,151	1,009,523,471	2,758,261	157	94:35	90	60	73.16	18,333,589

In April the left Gaskill engine and pump were run 122½ hours with the right engine shut down, making 196,160 revolutions.
In May the right Gaskill engine and pump were run 45 hours with the left engine shut down, making 67,821 revolutions.
In July the left Gaskill engine and pump were run 103½ hours with the right engine shut down, making 164,366 revolutions.
In July the two right pumps of the Quadruplex engines were run 12 hours with the left pumps cut off, making 17,410 revolutions.
In October, the left Gaskill engine and pump were run 1 hour with the right engine shut down, making 1674 revolutions.
[illegible] pumped in one day, 2,1[illegible] April 20th. [illegible] pumped in one day, 4,0[illegible] July 1st

Repairs on Main Distribution.

The total amount expended during the year for repairs on the main distribution system was $589.73.

For labor and material used in repairing 48 leaks,	$253 60
Testing and inspecting hydrants,	55 00
Repairs on hydrants,	168 97
Repairs on valves and renewing valve boxes,	84 30
Repairs caused by sewer contracts,	4 96
Refilling pipe trenches,	2 00
Repairs on tools,	4 15
Street car fares,	1 25
Cleaning wells,	15 50
	$589 73

The whole number of leaks in the main pipes was 48, of which 14 were burst pipe which it was necessary to renew; 28 were leaks in joints; 3 knot holes; 1 old sleeve joint; 1 old plug and 1 leak in lead joint on cast iron pipe. Three of the leaks were in the pipes on Center Avenue where cement sidewalks have been laid above them; in these cases the repairs to the walks were no inconsiderable item in the cost of the repairs.

The fire hydrants have been carefully inspected over the entire city twice during the year, the working parts thoroughly oiled, and any defect repaired. In addition to the regular semi-annual inspection, during very cold weather the inspection for frozen hydrants is continuous, particular attention being paid to those portions of the city where the drainage is defective, and to those hydrants which experience has shown to be most liable to be affected by frost.

The date, location and character of the several leaks in main pipes was as follows:

Date.	Pipe.	LOCATION.	Character.
Feb. 7, 1896	4 in. Wyckoff	Henry street, near Water	Burst.
" 18, "	6 " "	N. side Center, bet. Saginaw and Washington streets	Joint.
Apr. 16, "	10 " "	Second street, east of Madison	Burst.
" 18, "	12 " cast iron	Trumbull street, N. of Woodside	Lead joint.
" 21, "	10 " Wyckoff	Jennison Ave., bet. 33rd and 34th	Joint.
" 23, "	4 " "	Alley bet. Washington & Adams, at 10th St	Burst.
May 13, "	6 " "	Alley bet. Washington and Adams, bet. 8th and 9th	Joint.
" 18, "	4 " "	S. side Center bet. Water and Saginaw	Joint.
" 18, "	10 " "	Saginaw street, south of 10th street	Knot.
June 1, "	4 " "	Corner 6th and McLellan St..(to hydrant)	Joint.
" 5, "	6 " "	Alley bet. Washington and Adams, bet. 8th and 9th	Joint.
" 9, "	6 " "	N. side Center bet. Adams and Jefferson St.	Old plug.
" 11, "	6 " "	Water street at 6th street	Old sleeve.
" 12, "	8 " "	N. side Center west of Hampton	Knot.
July 1, "	10 " "	Van Buren street, bet. 4th and 5th streets	Joint.
" 3, "	10 " "	Second street at Grant street	Joint.
" 7, "	6 " "	Parker street at McEwan	Burst.
" 8, "	8 " "	Harrison street bet. 40th and 41st	Joint.
" 8, "	10 " "	Jennison Ave. bet. 35th and South Center	Joint.
" 9, "	6 " "	Alley bet. Washington and Adams, bet. 4th and 5th streets	Joint.
" 10, "	6 " "	Woodside avenue, at Sheridan street	Burst.
" 11, "	6 " "	Sherman street at First street	Knot.
" 14, "	8 " "	Alley bet. Jefferson and Madison, bet. 3rd and 4th streets	Joint.
" 15, "	6 " "	McLellan street, bet. Center and Sixth sts	Joint.
" 23, "	4 " "	Corner 3rd and Sherman.....(to hydrant)	Joint.
" 27, "	6 " "	Woodside ave., bet. Sherman and Sheridan	Burst.
" 29, "	8 " "	10th street, bet. Sherman and Sheridan	Joint.
" 29, "	6 " "	4th avenue, west of Green avenue	Joint.
Aug. 3, "	6 " "	Alley bet. Williams and Garfield, at 14th st.	Joint.
" 24, "	6 " "	N. side Center bet. Jefferson and Madison	Burst.
" 25, "	4 " "	Alley bet. Jackson and Van Buren street, bet. 7th and 8th	Burst.
" 27, "	8 " "	Eighteenth street at Broadway	Joint.
Sept. 4, "	8 " "	Tenth street at Grant	Joint.
" 10, "	6 " "	South side Center at Jefferson	Joint.
" 23, "	6 " "	Alley bet. Adams and Jefferson bet. 10th and 11th street	Burst.
" 24, "	6 " "	Wilson street, at 29th street	Joint.
" 25, "	8 " "	Alley bet. Jefferson and Madison, bet. 7th and 8th streets	Burst.
" 26, "	8 " "	Alley bet. Jefferson and Madison, bet. 8th and 9th streets	Joint.
" 28, "	8 " "	Alley bet. Jefferson and Madison, south of Center avenue	Joint.
Oct. 16, "	8 " "	Alley bet. Jefferson and Madison, south of Sixth street	Burst.
" 17, "	8 " "	Alley bet. Jefferson and Madison, bet. 8th and 9th streets	Burst.
" 19, "	6 " "	6th street east of Water	Joint.
" 19, "	8 " "	18th street, east of Broadway	Joint.
" 20, "	6 " "	South side Center, bet. Adams and Jefferson	Joint.
" 28, "	6 " "	Park avenue, at 4th street	Joint.
Nov. 10, "	6 " "	Water street, between 4th and 5th streets	Joint.
" 17, "	4 " "	Corner Center and Pendleton..(to hydrant)	Burst.
Dec. 10, "	6 " "	Parker street, at McEwan street	Burst.

Repairs and Care of Services.

The total amount expended on the repairs and care of services and turning on and off water was $394.53.

Turning on and off	$244 25
Inspecting services and notifying	65 25
Changing service connections	24 25
Labor and material used in repairs	60 78
	$394 53

The whole number of services shut off by employees of this department during the year was 367, of which 53 were shut at the request of the consumer, 123 were closed by reason of the premises being found vacant, 13 were closed for leaks, 100 were premises on which the water is in use only a portion of the year, nearly all of these being for lawn hose only, and 78 were turned off on account of non-payment of water rates. The number of services opened by employees of this department was 347. The 2 inch private mains which have been put in by consumers at their own expense on streets where there is no city main are a constantly increasing source of expense. Nine breaks have occurred in these pipes during the year, and have been repaired by this department.

Eight lead services found leaking, when the leakage was evidently due to damage done by employees of this department in the performance of their necessary work, or by sewer contractors in laying city sewers, have been repaired by this department without expense to the consumers.

Repairs and Care of Water Meters.

The total cost of maintenance and repairs on the meter system was $672.92, as follows:

Monthly inspection and reading	$249 25
Labor taking out and replacing and cleaning meters	149 50
Labor repairing broken meters	178 50
Parts of meters from manufacturers for repairs	34 84
Labor and material repairing meter boxes	50 24
Tools, pipe, fittings, &c., for repairs	10 59
	$672 92

No meters were injured by frost during the year, and none were returned to the manufactures for repairs, all necessary repairs having been done by the inspector. One hundred and six meters have

been found to require minor repairs, principally in the registering gear. One hundred and seventy have been found not registering properly but not broken; these have been promptly taken apart, the obstructions removed and again placed in service.

Service Connections.

The number of service connections put in during the year was 50, of which 19 were to replace connections taken out or abandoned. The number of service connections taken out was 17, making whole number of service connections with main pipes December 31st, 1896, 2,030.

These of the service connections heretofore reported as abandoned, were taken out during the year, and 35 services were abandoned but not taken out. Total number of abandoned service connections in main pipes 172, which leaves 1858 with services connected.

Service connections put in 1896:

	1 in.	¾ in.	⅝ in.	½ in.	Total
In cast iron mains	1	1	9	7	18
In Wyckoff mains	4	6	9	13	32
Totals	5	7	18	20	50

Service connections taken out in 1896:

	1 in.	¾ in.	⅝ in.	½ in.	Total
From Wyckoff mains	3	5	2	7	17

Total service connections in main pipes December 31st, 1896:

	Branches.					Corporation Stops.							Total
	8 in	6 in	4 in	3 in	2 in	2 in	1¼	1 in	¾	⅝	½	⅜	
In cast iron mains	1	3	10	3	4	2	4	58	67	67	123	5	367
In Wyckoff mains	1	3	16	1	2	4	....	184	446	420	600	6	1,663
Total	2	6	26	4	6	6	4	242	513	487	723	11	2,030

The abandoned connections not removed are:

	Branches.		Corporation Stops.					Total.
	4 in.	2 in.	1 in.	¾ in.	⅝ in.	½ in.	⅜ in.	
In cast iron mains.....	2	.....	8	9	4	11	4	38
In Wyckoff mains.....	3	1	21	50	14	45	.....	134
Total..	5	1	29	59	18	56	4	172

The number of separate services supplied through the new taps connected during the year is 54, and one service has been added in connection with old service connections. The number of separate services abandoned in connection with taps taken out or abandoned during the year was 52, leaving whole number of separate services connected with distribution system, 2,050.

Number of services open, ...1,446
Number of services shut off at curb, ... 604

Of the services shut off 168 are for supplying occupied dwellings, 134 are used for lawn hose only, and shut off for winter months, 73 are for supplying premises from which the buildings have been burned or removed and not rebuilt, 22 are for unoccupied buildings, 99 are for supplying stores, saloons, boarding houses and shops of various kinds, 13 are pipes put in for fire protection, 13 for supplying stables and barns, 7 are uncompleted services, 44 are premises shut off for non-payment, and 31 are supplies to premises now taking their supply from other services, but these services not permanently discontinued.

Appended to this report will be found the usual summary of statistics, also tables of uses for which water is supplied.

Respectfully submitted.

E. L. DUNBAR,
Superintendent and Secretary.

Summary of Statistics.

REPORT FOR 1896.

Water Works of Bay City, Michigan.
Built in 1872.
Owned by the City.
Source of supply, Saginaw Bay, an arm of Lake Huron.
Mode of supply, direct pumping.

PUMPING.

1. Builders of pumping machinery, Holly Manufacturing Company
2. Kind of fuel, coal, slack.
3. Fuel consumed, 1,574 tons coal, 94 cords wood.
6. Total water pumped, 1,009,523,471 gallons.
8. Average dynamic head, 113 feet.
   Cost of pumping based on total pumping station expenses, $7,356.71.
11. Per million gallons pumped, $7.29.
12. Per million gallons raised 100 feet, $6.45.
   Cost of pumping, based on total maintenance, including interest paid by city tax, $44,841.58.
13. Per million gallons pumped, $44.42.
14. Per million gallons raised 100 feet, $39.31.

CONSUMPTION.

1. Estimated population to date, 33,000.
2. Estimated population on pipe lines, 20,000.
3. Estimated population supplied, 14,000.
4. Total gallons supplied, 1,009,523,471.
5. Passed through domestic meters, 53,762,412 gals. 5.32 per cent.
6. Passed through manufacturing meters, 52,977,831 gals.. 5.25 per cent.
7. Average daily consumption, 2,758,261 gallons.
8. Gallons per day to each inhabitant, 83.
9. Gallons per day to each consumer, 197.
10. Gallons per day to each service distrbution (22) 1,484.

DISTRIBUTION.—MAINS.

1. Material, cast iron and Wyckoff patent
2. Size, 3 inch to 20 inch.
3. Extended 2,554 feet.
4. Discontinued, 6,830 feet.
5. Total in use, 43¼ miles.
6. Cost of repairs per mile, $13.63.
7 Leaks per mile, 1.
8. Small distribution, less than 4 inch, 319 feet.
9. Hydrants added, 6.
10. Number of hydrants in use, 393.
11. Stop gates discontinued, 8.
12. Number in use, 662.
13. Number of small gates less than 4 inches, 3.
14. Number of blow off gates, 20.
15. Ranges of pressure (domestic) at center, day and night, 35 to 38 pounds.

SERVICES.

16. Material, lead, wrought iron and Wyckoff.
17. Size, ⅜ inch to 8 inch.
21. Service taps added, 7.
22. Number in use, 1,858.
25. Meters added, 61.
26. Number in use, 620.

Financial—Maintenance.

RECEIPTS—DIVISION I.

A.	Water rates, domestic	$17,322 88	
B.	Water rates, manufacturing	5,741 98	
C.	Net receipts from water		$23,064 86
D.	Miscellaneous service connections, &c.		159 10
	E. Total		$23,223 96
	From public funds—		
J.	Tax levy for interest		$26,110 00
			$49,333 96

DIVISION II.

	From fixed rates—		
L.	Domestic	$10,646 64	
M.	Manufacturing	534 60	
	N. Total		$11,181 24
	From meter rates—		
O.	Domestic	$ 6,676 24	
P.	Manufacturing	5,207 38	
	Q. Total		$11,883 62

EXPENDITURES.

A. A.	Management and repairs	$18,731 58	
B. B.	Interest	26,110 00	
C. C.	Total maintenance for year		$44,841 58
D. D.	Balance to construction		4,492 38
			$49,333 96

Construction.

R.	Balance from previous years	$ 9,506 74	
	Balance from maintenance	4,492 38	
	Total		$13,999 12
F. F.	Extension of mains		$ 1,786 05
H. H.	Water meters		482 99
	Inlet from river		1,580 47
I. I.	Total for construction		3,849 51
	Balance		10,149 61
			$13,999 12

W. Net cost of works to date $[illegible]

X. Bonded Debt $[illegible]

Uses Supplied at Fixed Rates, January 1st, 1897.

Automatic Sprinkler,	2	Laboratory,	1
Bakeries,	3	Laundries,	2
Banks	1	Mattrass Factory,	1
Barber Shops,	8	Meat Warehouses	2
Bath Room, (public)	1	Offices	18
Bath Rooms, (Turkish)	2	Paint Shop,	1
Baths, (private)	85	Passenger Depot,	1
Blacksmith Shop,	1	Pawn Shop,	1
Boarding Houses,	3	Photograph Galleries,	4
Boilers, (power)	6	Plumbing Shop,	1
Bottling Works,	5	Printing Offices,	2
Business Blocks,	11	Restaurants	7
Business College,	1	Saloons,	39
Butcher Shops,	7	Schools,	15
Carriage Shops,	3	Shoe Shops,	1
Churches,	5	Skating Rinks,	2
Cigar Factory,	2	Stables (hotel)	4
Clothes Cleaning,	2	Stables (livery)	7
Chicory Factory	1	Stables (mill)	4
Dwellings,	615	Stables (private)	83
Express Office,	1	Stone Yard,	1
Familes in Blocks,	65	Stores,	74
Fire Pipes,	2	Tailor Shop.	1
Fountains,	1	Telegraph office,	1
Gas Engine,	1	Tin Shop,	1
Gas Works,	1	Undertaker's rooms	1
Green House	1	Water Closets and Urinals,	650
Halls (public)	5	Water Closets in Schools,	60
Harness Shops,	3	Water Motors	6
Hose for Sprinkling,	268	Warehouses,	2
Hotels	12		

Uses Supplied Through Meters, January 1st, 1897.

Armory,	1	Green Houses,	3
Ashery,	1	Halls (public)	11
Bakeries,	3	Hotels,	10
Banks,	3	Hose for Sprinkling,	346
Barber Shops,	2	Laundries	2
Bath Room, (public)	1	Locomotive Tank,	1
Baths, (private)	330	Locomotive Stand Pipe,	1
Bicycle Factory,	1	Machine Shops,	5
Blacksmith Shop,	1	Masonic Temple,	1
Boarding Houses,	2	Offices,	28
Boilers (power)	40	Opera House,	1
Boiler Shops,	4	Passenger Depots,	2
Bottling Works,	5	Pipe Factory,	1
Box Factories,	6	Paint Shop,	1
Brewery,	1	Planing Mills,	14
Business Blocks,	21	Plow Factory,	1
Business College,	1	Photograph Gallery,	1
Butcher Shops,	4	Printing Offices,	2
Carpenter Shop,	1	Railroad Coach Yard,	1
Carpet Cleaners,	1	Reel Factory,	1
Canning Factory,	1	Restaurants,	4
Cemetery,	1	Saloons,	11
Churches,	5	Salt Blocks,	9
Club Rooms,	2	Saw Mills,	9
Coal and Wood Yards,	2	Sash and Door Factories,	3
Court House,	1	School,	1
County Jail,	1	Stable, (bus)	1
Cracker Factory,	1	Stables, (hotel)	2
Cross Arm Factory,	1	Stables, (mill)	5
Crystal Water Works,	1	Stables, (street car)	1
Drill Houses,	3	Stables, (private)	80
Dwellings	455	Stables, (livery)	7
Electric Light Works,	1	Stores,	51
Elevator Tanks,	6	Telegraph Office,	1
Fire Pipes,	20	Undertaker's Room,	1
Flour Mills,	2	Water Closets and Urinals,	935
Foundries,	5	Water Motor Pumps,	62
Gas Engines,	2	Warehouse,	1
Government Building,	1	Wooden Ware Works,	1

Uses Shut off January 1st, 1897.

Baths, (private)	17	Harness Shop,	1
Bank,	1	Hotels,	13
Barber Shops,	5	Hose for Sprinkling,	162
Basement Room,	1	Laundry,	1
Billiard Hall,	1	Machine Shops,	5
Blacksmith Shops,	7	Market Garden,	1
Boarding Houses,	5	Mortar Yard,	1
Boilers, (power)	7	Offices,	8
Boiler Shops,	2	Paint shop,	1
Broom Factories,	2	Plumbers Shops,	2
Butcher Shop,	1	Planing Mill,	1
Business Block,	1	Printing Offices,	2
Carpet Cleaning,	1	Restaurants,	3
Carpenter Shop,	1	Saloons,	16
Cemeteries,	4	Saw Mills,	2
Cooper Shop,	1	Salt Blocks,	3
Candy Factory,	1	Shingle Mill,	1
Drill Houses,	5	Stores,	45
Dry Kiln,	1	Stables, (livery)	2
Dwellings,	211	Stables, (private)	20
Dye Works,	1	Stables, (mill)	2
Excelsior Factory,	1	Tool House,	1
Fair Grounds,	1	Vacant lots,	62
Fire Pipes,	8	Water Motors,	2
Fish Market,	1	Ware Houses,	2
Foundries,	2	Water Closets and Urinals,	75
Halls,	3		

City Uses for which no Payment is Made.

1 City Building, occupied by Police Station and City Offices.
1 City Building, occupied by Public Library and Water Office.
6 Steamer, Truck and Hose Houses, 20 horses, 2 steamers, 2 chemical engines.
17 Water Closets and 6 Baths in City Buildings.
1 Electric Light station.
11 Public Watering Troughs.
4 Ornamental Fountains.
10 Hose for Sprinkling Parks.
2 Street Sprinkling Carts.
393 Public Fire Hydrants.

For Operating Pumping Engines—Material used in 1896.

94	cords wood	cost $	115 75	
151	1485-2000 tons lump coal	"	345 82	
1422	497-2000 tons coal slack	"	2,597 01	
				$3,058 58
241	gallons cylinder oil	"	118 02	
7	gallons lard oil	"	3 20	
38	lbs. lubricant	"	2 74	
8½	" plumbago	"	1 35	
13½	" hemp packing	"	3 24	
1½	" cotton packing	"	57	
2½	" garlock packing	"	1 88	
½	lb. eureka packing	"	25	
3¼	lbs. eclipse packing	"	2 81	
25	" 1 inch square rubber packing	"	13 00	
3	" ¼ inch square rubber packing	"	1 20	
3½	" ⅝ inch square rubber packing	"	2 03	
24¾	" sheet rubber packing	"	6 73	
10½	" air pump valves	"	15 75	
50½	" leather	"	13 50	
8¼	" rivets	"	66	
463	" wiping rags	"	20 83	
130	" cotton waste	"	6 50	
14	bars soap	"	52	
212	lbs. floor soap	"	10 72	
1	dozen brooms	"	3 00	
460	gallons kerosene oil	"	35 69	
31	lamp chimneys	"	1 62	
4	lantern globes	"	33	
2½	dozen lamp wicks	"	25	
	Repairs on lamps	"	7 60	
11	dozen boxes matches	"	1 55	
5	lbs. rotten stone	"	40	
5	lbs. red lead	"	50	
1	gallon linseed oil	"	60	
	Emery and emery cloth	"	1 00	
	Copper wire	"	65	
	Files, saw blades, &c	"	3 43	
	Oil cans, oilers, &c	"	3 75	
	Shovels, wheelbarrow, &c	"	9 64	
	Solder, staples, &c	"	85	
	Gas pipe and fittings	"	18 18	
	Water pail and ice	"	13 90	
	Rent of telephone	"	40 00	
	Record blanks	"	10 00	328 44
				$3,387 02

Material on hand December 31st 1896.

47	cords wood	cost	$ 23 50	
26	1515-2000 tons lump coal	"	69 03	
52	1273-2000 tons coal slack	"	91 06	
				$183 59
30	gallons cylinder oil	"	15 00	
45	lbs. lubricant	"	3 15	
4	" plumbago	"	40	
2	" hemp packing	"	48	
25	" cotton packing	"	5 00	
40	" 1 inch square rubber	"	24 00	
½	lb. garlock packing	"	37	
2	lbs. heston cone packing	"	3 00	
2½	" eclipse packing	"	1 88	
2	" sheet rubber	"	70	
6	" boiler gaskets	"	3 87	
7	" leather	"	1 89	
6	" rivets	"	48	
195	" floor soap	"	10 24	
1	broom	"	25	
15	gallons kerosene oil	"	1 12	
51	lamp chimneys	"	2 83	
2	lantern globes	"	17	
1½	dozen lamp wicks	"	15	
11	dozen boxes matches	"	1 50	
10	lbs. rotten stone	"	80	
½	lb. oxalic acid	"	20	
½	lb. emery	"	10	
	Lawn hose	"	5 75	
	Steam hose	"	25 75	
	Boiler hose	"	23 40	132 48
				$316 07



Water Department.

Bay City Michigan



Twenty-Sixth

ANNUAL REPORT

December 31st, 1897



Twenty-Sixth

ANNUAL REPORT

—OF THE—

WATER DEPARTMENT

—OF—

BAY CITY, MICHIGAN.

December 31st, 1897.

BAY CITY, MICH.
C. & J. GREGORY CO., PRINTERS.
1897.

Water Department.

1898.

COMMISSIONERS.

SANFORD V. WILKIN, PRESIDENT.
(Term Expired Sept. 6th, 1897.) No appointment.

LOUIS MORITZ,
(Term Expires Sept. 6th, 1898.)

DUNCAN McGREGOR,
(Term Expires Sept. 6th, 1899.)

FREMONT J. TROMBLE,
(Term Expires Sept. 6th, 1900.)

ANDREW WALTON,
(Term Expires Sept. 6th, 1901.)

G. HENRY SHEARER,
(Term Expires Sept. 6th, 1902.)

BENJAMIN F. RAY,
(Term Expires Sept. 6th, 1903.)

OFFICERS AND EMPLOYES.

E. L. DUNBAR.....Supt. & Secy.
T. A. DELZELL.....Office Assistant.
F. H. COLLINS.....Inspector.
L. D. CARPENTER.....Reservoir Keeper.
THOMAS LARDNER.....Turnkey.
A. B. VERITY.....First Engineer.
JAS. E. DARLING.....Second Engineer.
JAS. H. McGIBBONS.....Fireman.
FRANK O'HARE.....Fireman.

Superintendent's Report.

To the Honorable the Board of Water Works of Bay City, Michigan:

Gentlemen:—I respectfully submit the following report of the operations of the Water Department for the year ending December 31st, 1897.

The breakwaters along the banks of the inlet cut at the bay have been extended about 1,000 feet on each side of the cut, and the stone filling of this extension and that driven in 1896 completed at a cost of $3,825.52.

The main distribution has been extended by the laying of 4,403½ feet of new cast iron pipe; 646 feet of old mains have been abandoned.

Ten new fire hydrants have been added, making whole number of fire hydrants in service 403.

About 3,600 feet of 8-inch cast iron pipe, to be used in replacing old mains, was received too late for laying in the fall, but will be placed in the ground as early in the coming season as the weather will permit.

The meter system has been extended by the placing of 61 additional meters, making whole number of meters in service 681.

The total quantity of water pumped was 944,546,290 gallons, a decrease from 1896 of 64,978,181 gallons, or nearly 6½ per cent. This decrease has been caused less from the shutting off of leakage, than from the actual supply to consumers.

The records of the supply through meters show a less quantity supplied for both domestic and manufacturing purposes in 1897, than during the last preceding year.

The receipts from water supplied at fixed rates were also less in 1897 than in 1896, a larger number of places having been shut off in 1897 than in 1896.

The water level in the bay continues to rise, which, with the improvements to the inlet works, has still further reduced the use of the supply from the river. The river supply was drawn upon but about 36 hours in 1897, and in every case it was during the progress of fires which required a considerable number of streams, and the demand was too great for the capacity of the pipe from the bay.

Should the new industries which are being inaugurated in and near the city result in an increased demand upon this department, as anticipated, prompt action toward the construction of a new inlet from the bay will be necessary, and it becomes more evident each year that the new inlet, when constructed, should be laid from the west side of the bay.

Greater depth of water at the same distance from the pumping station, better quality of water at present, and much less danger of contamination by the discharge from the river, are indisputable arguments in favor of the west side of the bay as a source of supply.



FINANCIAL.

Receipts.

The receipts of the department for the year have been:

From water rates roll of 1893	$ 49 28	
From water rates, roll of 1894	11 00	
From water rates, roll of 1895	3 13	
From water rates, roll of 1896	859 39	
From water rates, roll of 1897	21,196 48	
Total from water rates		$22,119 28
From plumbers' licenses	$ 57 50	
From service connections	169 00	
From rent of boom	90 00	
From repairs on engines and boilers	4 00	
From cast iron pipe	14 94	
Total miscellaneous		335 44
		$22,454 72

The receipts by months have been:

January	$ 1,052 80
February	665 91
March	1,456 01
April	1,546 12
May	888 52
June	2,064 68
July	2,372 08
August	1,495 69
September	1,490 83
October	2,015 19
November	1,148 14
December	6,388 82
	$22,454 72

Expenditures.

The expenditures of the department during the year have been:

FOR MAINTENANCE ACCOUNTS.

Office department:

Superintendent and Secretary's salary	$ 1,611 00
Office assistant	716 00
Office expenses	383 82

Street and service department:

Repairs on main distribution	$ 579 52	
Repairs and care of services	468 77	
Repairs and care of water meters	640 97	
Repairs and care of inlet works	4,389 93	
Service connections	46 77	
Pumping department:		
Salaries of engineers and firemen	3,412 34	
Fuel	2,475 86	
Oil, packing and supplies	338 47	
Repairs to engines and boilers	473 00	
Repairs to boiler arches	89 89	
Repairs to engine house and grounds	388 91	
Total for maintenance accounts		$16,015 25

FOR CONSTRUCTION ACCOUNT.

Water meters:		
New meters	513 74	
Setting meters	16 72	
Main distribution:		
Cast iron pipe	2,812 01	
Valves	103 04	
Fire hydrants	263 82	
Laying pipe	659 97	
Total for construction		$ 4,369 70
Total expenditures		$20,384 55

BOND ACCOUNT.

The city has issued $20,000 of new bonds dated October 15th, 1897, and payable October 15th, 1927, bearing interest at the rate of 4 per cent. per annum. The proceeds from the sale of these bonds were used to redeem Series No. 11 and Series No. 31 of the original issue of bonds for the construction of water works, dated January 15th, 1872, and October 15th, 1874, respectively, and payable October 15th, 1897.

The total amount of water works bonds outstanding is $362,000, of which $227,000 bear interest at the rate of 8 per cent. per annum, $60,000 bear interest at the rate of 4 per

cent. per annum, and $75,000 bear interest at the rate of 5 per cent. per annum; $90,000 of bonds originally issued for the construction of water works have been paid and retired.

The interest on outstanding bonds payable during the year, amounting to $25,310.00, has been paid by the City Treasurer from moneys raised by tax levy.

Total amount paid for interest on water works bonds since they were issued, $711,095.00; amount of water works bonds paid, $90,000.00; total amount of bonds issued for construction of water works, $452,000.00.

The water works bonds outstanding, with date of issue, when payable, and rate of interest, is as follows:

Bonds Outstanding December 31st, 1897.

Series.	Date of Issue.	Date Payable.	Amount.	Interest
No. 12	January 15, 1872	October 15, 1898	$ 8,000 00	8 per cent.
" 13	August 15, 1872	Feb'y 16, 1899	10,000 00	"
" 14	" " "	" " 1900	10,000 00	"
" 15	" " "	" " 1901	10,000 00	"
" 16	" " "	" " 1902	10,000 00	"
" 17	" " "	" " 1903	10,000 00	"
" 18	" " "	" " 1904	9,000 00	"
" 19	August 15, 1873	" " 1905	10,000 00	"
" 20	" " "	" " 1906	10,000 00	"
" 21	" " "	" " 1907	10,000 00	"
" 22	" " "	" " 1908	10,000 00	"
" 23	" " "	" " 1909	10,000 00	"
" 24	Feb'y 15, 1874	" " 1910	10,000 00	"
" 25	April 15, 1874	April 15, 1911	10,000 00	"
" 26	" " "	" " 1912	10,000 00	"
" 27	" " "	" " 1913	20,000 00	"
" 32	October 15, 1874	October 15, 1898	10,000 00	"
" 33	March 1, 1875	March 1, 1900	10,000 00	"
" 34	" " "	" " 1901	10,000 00	"
" 35	June 1, 1875	June 1, 1902	10,000 00	"
" 36	" " "	" " 1903	10,000 00	"
" 37	" " "	" " 1904	10,000 00	"
Not Series:				
Nos. 1 to 25	May 1, 1891	May 1, 1905	25,000 00	5 per cent.
Nos. 26 to 50	" " "	" " 1911	25,000 00	"
Nos. 51 to 63	" " "	" " 1917	12,500 00	"
Nos. 64 to 76	" " "	" " 1918	12,500 00	"
Refunding:				
Nos. 1 to 20	October 1, 1895	October 1, 1920	20,000 00	4 per cent.
Nos. 1 to 20	October 1, 1896	" 1921	20,000 00	"
Nos. 1 to 20	October 15, 1897	" 15 1927	20,000 00	"
			$362,000 00	

Account with Water Works Fund and City Treasurer.

The receipts of the department have been deposited with the City Treasurer each month, and by him placed in the Water Works Fund. No moneys have been withdrawn from that fund, except as provided in Section 84 of the city charter. A statement has been filed with the City Recorder each month, showing the name of claimant, and for what purpose the indebtedness was incurred, whereupon the Recorder has issued his warrant for the amount of such claims, which warrant has been duly filed with the City Treasurer and the amount placed to the credit of the Board of Water Works, and charged against the Water Works Fund. The amounts credited to the Board of Water Works have been used to pay the orders of the Secretary of this Board, issued in payment of the claims specified in the statement filed with the City Recorder.

Water Works Fund:

	Dr.	Cr.
Balance in fund January 1st, 1897	$10,149 61	
Collections deposited with City Treasurer	22,454 72	
By Recorder's warrants Nos. 335 to 346		$20,384 55
Balance in fund December 31st, 1897		12,219 78
	$32,604 33	$32,604 33

City Treasurer as Treasurer of Board:

	Dr.	Cr
To Recorder's warrants Nos 335 to 346	$20,384 55	
By paid orders of E. L. Dunbar, Secretary, No. 3910 to No. 4293, inclusive		$20,384 55
	$20,384 55	$20,384 55

Water Rates.

The total amount charged on the roll of 1897 was:

For water supplied at fixed rates	$10,731 70
For water supplied through meters	11,633 89
	$22,365 59

The amounts collected on roll of 1897 were:

From fixed rates	$10,253 15
From metered water	10,943 33
	$21,196 48

The amount uncollected on roll of 1897 at the close of the year:

From fixed rates	$ 478 55
From metered water	690 56
	$ 1,169 11

The amount collected from previous year's rolls during the year 1897 was:

From fixed rates	$ 361 24
From metered water	561 56
	$ 922 80

The total amount collected on all rolls was:

From fixed rates, domestic	$10,146 66
From meter water, domestic	6,587 43
From fixed rates, manufacturing	467 73
From metered water, manufacturing	4,917 46
	$22,119 28

The total amount of water rates collected and uncollected since the works commenced operations has been as follows:

YEAR.	COLLECTED.	UNCOLLECTED.	TOTAL ON ROLL.
1873. January 1st to April 30th.	$ 728 82		$ 728 82
1873-4, May 1st, 1873 to April 30th, 1874	5,440 80	$ 1 60	5,442 40
1874-5, May 1st, 1874, to April 30th, 1875	6 908 16	44 85	6,953 01
1875. May 1st to December 31st	7.269 55	28 46	7,298 01
1876	9.571 26	82 73	9,653 99
1877	9.604 26	134 19	9,738 45
1878	10 078 15	324 71	10,402 86
1879	11.708 97	136 07	11,845 04
1880	13,155 74	120 25	13,275 99
1881	15.002 61	212 40	15,215 01
1882	17.352 47	158 85	17,511 32
1883	18.713 46	98 64	18,812 10
1884	18,892 02	129 89	19,021 91
1885	19.716 73	269 58	19,986 31
1886	19,350 61	124 74	19,475 35
1887	19,436 25	87 00	19,523 25
1888	21.278 62	120 80	21,399 42
1889	22.120 47	113 03	22,233 50
1890	23,297 81	202 81	23,500 62
1891	24,619 51	286 35	24,905 86
1892	24 185 81	280 32	24,466 13
1893	23,658 69	501 44	24,160 13
1894	22.791 40	576 11	23,367 51
1895	22 892 03	340 77	23,232 80
1896	23.039 27	388 65	23,427 92
1897	21,196 48	1,169 11	22,365 59
Totals	$432,009 95	$5,933 35	$437,943 30

Balance Sheet—Bay City Water Works, 1897.

	Dr.	Cr.
Folio 174, Water rates, Roll of 1897		$21,196 48
" 173, Water rates, Roll of 1896		859 39
" 175, Water rates, Roll of 1895		3 13
" 175, Water rates, Roll of 1891		11 00
" 175, Water rates, Roll of 1893		49 98
" 176, Plumbers' licenses		57 50
" 177, Rents, dockage, etc		90 00
" 185, Service connections		122 23
" 178, City Water Works fund	$ 2,070 17	
" 179, Office department, salaries	2,327 00	
" 193, Office department, expenses	383 82	
" 192, Street and service dep't, repairs on main distribution	579 52	
" 182, Street and service dep't, repairs and care of services	468 77	
" 193, Street and service dep't, repairs and care of water meters	640 97	
" 194, Street and service dep't, repairs and care of inlet works	4,389 93	
" 186, Pumping department, salaries	3,412 34	
" 187, Pumping department, fuel	2,475 86	
" 195, Pumping department, oil, packing and supplies	338 47	
" 189, Pumping department, repairs on engines and boilers	469 00	
" 191, Pumping department, repairs to boiler arches	89 89	
" 190, Repairs to engine house and grounds	398 91	
" 194, Water meter account, new meters	513 74	
" 195, Water meter account, setting meters	16 72	
" 196, Main distribution, cast iron pipe	2,797 07	
" 197, Main distribution, valves	103 04	
" 197, Main distribution, fire hydrants	263 82	
" 198, Main distribution, laying pipe	659 97	
	$22,389 01	$22,389 01

Ledger Balances—December 31st, 1897.

LEDGER E.	Dr.	Cr.
Folio 1, Bay City bond account, ($452,000 bonds)		$443,045 87
" 1, Water assessment, frontage on pipe		736 07
" 25, Water rates		432,019 95
" 22, Plumbers' licenses		360 20
" 21, Service taps and service boxes		3 479 49
" 21, Rents, dockage, etc		2,627 83
" 2, Construction—real estate	$ 6,724 83	
" 2, " dock, tramway and store shed	1 882 63	
" 3, " engine house, chimney and wells	21,401 43	
" 3, " engine foundations, boiler foundations and arches	6,777 45	
" 4, " pumping machinery	59,427 72	
" 4, " inlet from Saginaw river	4,799 46	

Folio 5.	Construction—	inlet from Saginaw bay	$ 84 778 37	
" 5,	"	reservoir, breakwater, etc	24.713 78	
" 6,	"	iron pipe and branch castings	110,596 12	
" 6,	"	Wyckoff patent pipe	136,441 31	
" 7,	"	valves for street mains	15,979 51	
" 7,	"	public fire hydrants	15,336 27	
" 8,	"	laying pipe	59,512 07	
" 8,	"	buildings at bay	452 46	
" 12,	"	water meters	17,134 92	
" 9,	"	furniture and fixtures	990 96	
" 10,	"	implements	1,713 61	
" 10,	"	engineering and general superintendence	7,856 17	
" 11,	"	traveling expenses	306 29	
" 11,	"	insurance	29 00	
" 11,	"	interest, discount and commissions	4,234 17	
" 29.	Maintenance—	office expenses and salaries	60,056 75	
" 29,	"	repairs and care of hydrants, valves and pipes	18,562 42	
" 30,	"	repairs and care of water meters	5,362 45	
" 30,	"	repairs and care of inlet works	34,081 17	
" 31,	"	repairs to engine house, etc.	3,440 42	
" 15,	"	repairs to dock	13 38	
" 32,	"	engineers' and firemen's wages	88,182 15	
" 32,	"	fuel	67,003 87	
" 33,	"	oil, packing and supplies	9,460 00	
" 33,	"	repairs to pumping machinery	7,134 14	
" 18,	"	repairs to engine foundations	51 46	
" 18,	"	repairs to boiler arches	1,273 19	
" 19,	"	implements	1,129 37	
" 19,	"	interest	3,709 84	
" 20,	City Water Works fund		12,219 78	
			$882,758 91	$882,758 91

MAIN DISTRIBUTION

The length of main pipe laid during the year was 4,403½ feet, as follows :

10 inch cast iron	4½ feet.
8 inch cast iron	93 feet.
6 inch cast iron	4,217 feet.
4 inch cast iron	89 feet.
	4,403½ feet.

The length of pipe abandoned was 646 feet, as follows :

6 inch cast iron	7 feet.
10 inch Wyckoff	4½ feet.

8 inch Wyckoff	10 feet.
6 inch Wyckoff	614 feet.
4 inch Wyckoff	10½ feet.
	646 feet.

Total length of distributing mains in service December 31st, 1897, 232,066¾ feet.

The main pipes laid during the year were :

In alley between Washington and Adams streets, at north side of Fourth street, setting hydrant removed from Third street. 8 feet 4 inches cast iron pipe.

Atlantic street, from Parker street to Woodside avenue, 682 feet 6 inch cast iron pipe, 7 feet 4 inch cast iron pipe.

Woodside avenue, from Atlantic street to Duplante street, 93 feet 8 inch cast iron pipe. 6½ feet 4 inch cast iron pipe.

Duplante street, from Woodside avenue to Nabobish avenue, 1,378 feet 6 inch cast iron pipe, 21 feet 4 inch cast iron pipe.

Johnson street in Fourth avenue, 4½ feet 10 inch cast iron branch to connect main in Fourth avenue.

Fourth avenue, from Johnson to Trumbull streets, 1 098 feet 6 inch cast iron pipe, 27 feet 4 inch cast iron pipe.

Wilson street, from Fremont avenue to Thirty-Second street, 1,059 feet 6 inch cast iron pipe, 19½ feet 4 inch cast iron pipe.

The number of valves set in the distributing mains during the year was 19 :

6 inch Flower valves	8
4 inch Flower valves	11

The number of valves taken out not before reported as abandoned was 3 :

8 inch Flower valves	1
6 inch Flower valves	1
4 inch Flower valves	1.

The following described valves, abandoned in 1896, were taken out in 1897 :

10 inch Flower valves	2
8 inch Flower valves	1
4 inch Flower valves	13

Whole number of valves in service in connection with the distributing mains, 678.

The number of new fire hydrants set during the year was 10, all of which were of the Matthews pattern, with two discharge nozzles made by R. D. Wood & Co.

The location of these hydrants is :

S. W. corner of Atlantic and Water streets.
N. W. corner of Atlantic street and Woodside avenue.
N. W. corner of Duplante and Sophia streets.
N. W. corner of Duplante and Brent streets.
N. W. corner of Duplante street and Nabobish avenue.
N. E. corner of Fourth avenue and Chase street.
N. E. corner of Fourth avenue and Pendleton street.
N. E. corner of Wilson and Thirtieth streets.
N. E. corner of Wilson and Thirty-First streets.
N. E. corner of Wilson and Thirty-Second streets.

The hydrant before located on the south side of Third street, at the alley between Washington avenue and Adams street, has been taken out and reset on the north side of Fourth street, at the same alley.

The cost of the several lines of pipe laid during the year was as follows :

Resetting hydrant on Fourth avenue, at the alley between Washton avenue and Adams street	11 00
Atlantic street, from Parker street to Woodside avenue	336 03
Woodside avenue, from Atlantic street to Duplante street	94 46
Duplante street, from Woodside avenue to Nabobish avenue	681 19
Johnson street branch for Fourth avenue pipe	25 50
Fourth avenue, from Johnson street to Trumbull street	498 25
Wilson street, from Fremont avenue to Thirty-Second street	512 29
Cost of taking out valves and castings on Water and Harrison streets	52 25
The value of material purchased during the year and left in stock at the close of the year is	1,627 87
Total amount expended during the year on this branch of the service	$3,838 84

Main pipe in service December 31st, 1897 :

	Cast Iron.	Wyckoff.	Total.
20 inch	9,563 ft		9,563 ft.
16 inch	13,778 "		13,778 "
12 inch	9,083 "		9,083 "
10 inch	11,106½ "	28,034½ ft.	39,141 "
8 inch	5,279 "	25,216¼ "	30,495¼ "
6 inch	16,911½ "	89,686 "	106,597½ "
4 inch	1,499¼ "	21,590¾ "	23,090 "
3 inch		319 "	319 "
Total	67,220¼ ft.	164,846½ ft.	232,066¾ ft.

Total cast iron mains.....12 miles, 3,960¼ feet.
Total Wyckoff mains.....31 miles, 1,166½ feet.

Total mains.....43 miles, 5,036¾ feet.

Percentage of each size of pipe :

20 inch..... 4.12 per cent.
16 inch..... 5.94 per cent.
12 inch..... 3.91 per cent.
10 inch..... 16.87 per cent.
8 inch..... 13.14 per cent.
6 inch..... 45.93 per cent.
4 inch..... 9.95 per cent.
3 inch..... .14 per cent.

100.00

Valves in service December 31st, 1897.

	20 in.	16 in.	12 in.	10 in.	8 in.	6 in.	4 in.	3 in.	Total.
Flower Patent..	4	9	3	35	42	170	346	3	612
Galvin's Patent.			2		1	5	45		53
Brown Patent..			1			1			2
Eddy Patent....						5	6		11
Total.....	4	9	6	35	43	181	397	3	678

Blow-off gates included in above :

Three.....6 inch.
Fifteen.....4 inch.
Two.....3 inch.

Fire hydrants in service December 31st, 1897:

Matthews, 6 inch inlet, 3 hose nozzles, gated	32
Matthews, 4 inch inlet, 2 hose nozzles	200
Bourbon, 6 inch inlet, 3 hose nozzles gated	5
Bourbon, 4 inch inlet, 2 hose nozzles	10
Holly, 4 inch inlet, 2 hose nozzles, gated	4
Holly, 4 inch inlet, 2 hose nozzles	129
Gaskill, 4 inch inlet, 2 hose nozzles	16
Galvin, 4 inch inlet, 2 hose nozzles	5
Morgan, 4 inch inlet, 2 hose nozzles	1
Brown, 4 inch inlet, 2 hose nozzles	1
	403

WATER METERS.

The number of water meters set during the year was 75, and the number of meters taken out was 14, making total number of meters in service December 31st, 1897, 681.

Manufacturing meters	99
Domestic meters	580
Test meters	2
	681

Amount expended on the meter system during the year:

55 new metets purchased	$513 74
Meter fittings and setting meters	16 72
	$530 46

Total cost of meter system to December 31st, 1897:

681 meters in service	$15,166 83
40 meters in stock	1,069 46
Meter fittings in stock	79 85
Labor, etc., on 98 meters permanently removed	818 78
	$17,134 92

Meters bought in 1897:

⅝ Columbia	6
⅝ Empire A. A	20
⅝ Hersey Disc	5
⅝ Thomson Lambert	6
⅝ Trident	18

Meters taken out in 1897 :

	3 in.	1 in.	¾ in.	⅝ in.	½ in.	⅜ in	Total.
Union Rotary	1						1
Union Duplex				1			1
Crown		1				1	2
Empire			1		2		3
Hersey				1			1
Thomson			1	4			5
Thomson Bee					1		1
Totals	1	1	2	6	3	1	14

Meters set in 1897 :

	3 in.	1½ in	1 in.	¾ in	⅝ in.	½ in.	⅜ in.	Total
Union Rotary	1	1						2
Union Duplex					1			1
Columbia					6			6
Crown			1	1		2	1	5
Empire				3		3		6
Empire A. A					17			17
Hersey					1			1
Hersey Disc					9			9
Thomson					1			1
Thomson Lambert					3			3
Trident					23			23
Westinghouse					1			1
Total	1	1	1	4	62	5	1	75

Meters in service December 31st, 1897 :

	8 in.	4 in.	3 in.	2 in.	1½ in	1 in.	¾ in.	⅝ in.	½ in.	⅜ in.	Total
Union Rotary	1	6	17	6	4	3		42			79
Union Duplex								19			19
Columbia								11			11
Crown					1	22	34		28	42	127
Empire						3	32		20		55
Empire A. A								23			23
Nash								20			20
Gem				1							1
Worthington				7	4			16			27
Hersey						2	5	25			32
Hersey Disc								26			26
Thomson						2		98			100
Thomson Bee								18	71		89
Thomson Lambert								9			9
Trident								60			60
Westinghouse								4			4
Total	1	6	17	14	9	32	71	370	119	42	681

Meters in stock Dec. 31, 1897:

	3 in.	1½ in.	1 in.	¾ in.	⅝ in.	½ in.	Total
Union Rotary	4			1			5
Union Duplex					3		3
Crown			3				3
Empire			3	3		5	11
Empire A. A.					3		3
Worthington		2					2
Hersey					1		1
Thomson				2	4		6
Thomson Bee						1	1
Thomson Lambert					3		3
Westinghouse					2		2
Totals	4	2	6	6	16	6	40

INLET WORKS.

The breakwaters along the banks of the inlet cut were extended during the year on the east side of the cut 1,010 feet, and on the west side of the cut 976 feet. The stone filling of these breakwaters, and that of the breakwaters driven in 1896, unfinished at the close of that year, has been fully completed, and the rip-rap work on the inner slopes of the cut has been raised to protect the banks at a higher elevation, this being rendered necessary by the higher stage of water in the bay.

The amount expended on these improvements during the year was $3,825.52.

The total amount expended on the improvement of the inlet works at the bay since the work was commenced in 1894 is $21,487 06.

These improvements have consisted of the cleaning and deepening of the inlet basin; paving the inner slopes with brick; the removal of the timber work at the basin, and the construction of a substantial earth dam between the inlet cut and basin with substantial stone masonry influent and effluent chambers to basin, with a 30-inch cast iron pipe through the

dam; the extension of the breakwaters along the inlet cut on the east side 2,304 feet, and on the west side 2,265 feet, and the partial cleaning of the inlet cut.

In view of the probability of the construction of a new inlet from the west side of the bay in the near future, no further extension of the old works is advisable.

The only work remaining to be done to enable the works to derive the full benefit of what has been done, is the cleaning out of the inlet cut from the end of the breakwaters to the inlet basin, a distance of about 3,000 feet.

Should it be determined to retain the inlet works in their present location for some years, it would be advisable to clean out the old cut to the full depth and width to which it was originally dredged, and which would require the removal of (approximately) 30,000 cubic yards of material, but if the works are soon to be removed, it will not be necessary to remove more than one-half of this material, as a cut fifty feet in width, and to a depth of five feet of water at its ordinary stage, would probably be kept open two or three years without very much expense.

PUMPING STATION.

The grounds at the pumping station have been filled up to a proper level, and neatly graded from Water street back to the siding leading to the coal sheds, and shade trees planted along the front of the grounds.

The amount expended upon this improvement was $358.92.

The principal repairs on the engines and boilers have consisted of quite extensive repairs on No. 2 boiler. The three old boilers, which have now been in service 25 years, cannot be relied upon for severe or pro-

tracted service, such as may be required of them at any time. Steps are now being taken to replace one of them with a new boiler, and there should be no unnecessary delay about replacing the other two.

The plungers of the Gaskill pumps, which have been in constant service for ten years, had become worn so that it was difficult to keep them properly packed to prevent leakage. These plungers were taken out and turned off to a true surface.

The quantity of water pumped during the year was 944,545,290 gallons, a daily average of 2,587,795 gallons.

928,573,106 gallons were pumped against a domestic pressure of 40 lbs. per square inch, and 15,972,184 gallons were pumped against an average fire pressure of 73¾ lbs. per square inch.

The average lift of all the water pumped from the surface of the water in the suction wells was 113 feet.

The fuel used was principally coarse slack from the mines in Monitor, in this county.

The quantity of fuel purchased during the year was:

2¾ tons Ohio lump @ $2.75 per ton		$ 7 56
19 7-20 tons Saginaw lump @ $2 10 per ton		40 63
23 4-5 tons Monitor lump @ $2.25 per ton		53 55
26¼ tons Monitor lump @ $2 00 per ton		52 50
25 7-20 tons Bay Mining Co. lump @ $1.95 per ton		49 43
757⅞ tons Monitor slack @ $1.65 per ton		1,250 36
289 3-5 tons Monitor slack @ $1.25 per ton		361 97
426 11-20 tons Bay Mining Co. slack @ $1.25 per ton		533 19
Unloading from cars to bin		124 67
Transfer on one car Saginaw coal		2 00
		$2,475 86
97¼ tons lump coal in bins ($2.18)	$ 212 87	
1,474 50-2,000 tons slack coal in bins ($1.53)	2,262 99	
	$2,475 86	

The quantity of fuel on hand at the commencement of the year was :

47 cords wood cost	$ 23 50
26 1,515-2,000 tons Monitor lump coal cost	69 03
52 1,273-2 000 tons Monitor slack coal cost	91 06
	$ 183 59

The quantity of fuel on hand at the close of the year was:

36 cords wood cost	$ 18 00
47 120-2,000 tons slack coal cost	62 50
12 1,890-2,000 tons lump coal cost	26 37
	$ 106 87

Fuel consumed during the year :

11 cords wood cost	$ 5 50
111 625-2,000 tons lump coal cost	255 62
1,479 1,203-2,000 tons slack coal cost	2,291 46
	$2,552 58

The right Gaskill pump was run 8,669 19-60 hours, and the left Gaskill pump 8,628 49-60 hours.

The quantity of water pumped by the Gaskill engines and pumps was 932,268,982 gallons.

The quadruplex engines and pumps were run 102 31-60 hours, pumping 11,870,705 gallons.

The rotary pumps were run 4 26-60 hours, pumping 405,603 gallons.

The works were run under fire pressure 86 32-60 hours.

The total amount expended during the year for operating the pumping engines was:

For salaries of engineers and firemen	$3,412 34
For fuel	2,475 86
For oil, packing and engineer supplies	338 47
For repairs on engines and boilers	473 00
For repairs on boiler arches	89 89
	$6,789 56

The net cost of operating the pumping engines was:

For salaries of engineers and firemen	$3,412 34
For fuel consumed	2,552 58
For oil, packing, etc., used	352 39
For repairs	562 89
	$6,880 20

The cost of pumping, based on total net cost of operating pumping engines, $6,880.20, was:

Per million gallons pumped	$ 7 28
Per million gallons raised 100 feet	6 44

The cost of fuel was:

Per million gallons pumped	$ 2 70
Per million gallons raised 100 feet	2 39

The pumping plant consists of:

BOILERS.

Five in number, all horizontal tubular boilers, set in separate brick arches.

Three boilers are 16 feet long, 66 inches in diameter, with 105 tubes 16 feet long and $2\frac{3}{4}$ inches interior diameter in each boiler. Two boilers are 16 feet long, 60 inches in diameter, with 48 tubes 16 feet long and $3\frac{3}{4}$ inches interior diameter in each boiler. The area of grate surface under each boiler is as follows: No. 1, $27\frac{1}{2}$ square feet; Nos. 2 and 3, each 34 square feet; Nos. 4 and 5, each $22\frac{1}{2}$ square feet.

Heating surface: Nos. 1, 2 and 3, each ($\frac{1}{2}$ shell 138 24-100 square feet, entire tubes 1,209 51-100 square feet) 1,347 75-100 square feet; Nos. 4 and 5, each ($\frac{1}{2}$ shell 125 66-100 square feet, entire tubes 753 98-100 square feet) 879 64-100 square feet.

ENGINES AND PUMPS.

One Gaskill horizontal compound condensing crank and fly wheel pumping engine; maximum capacity, 5,000,000 gallons in 24 hours.

One Holly quadruplex compound condensing crank and fly wheel pumping engine; maximum capacity, 3,000,000 gallons in 24 hours.

One horizontal high pressure piston engine, driving through gear, two No. 10 Holly rotary pumps; maximum capacity, 2,500,000 gallons in 24 hours.

Capacity of Gaskill pumps per revolution, 119 gallons.

Capacity of quadruplex pumps per revolution, 55 gallons.

Capacity of rotary pumps (2) per revolution, 17 gallons.

WATER PUMPED—1897.

Month.	Gaskill Engine.			Quadruplex Engines.			Rotary Pumps			Totals.		Fires.					
	Hours Run.	Revolutions.	Gallons Pumped.	Hours Run.	Revolutions.	Gallons Pumped.	Hours Run.	Revolutions	Gallons Pumped.	Gallons Pumped.	Daily Average.	No. Alarms.	Hours Run.	Highest Pressure	Lowest Pressure	Average Pressure	Gallons Pumped.
January...	741:15	666,864	80,569,544	2:45	7,810	429 550	.....	... ...	.....	80,999,094	2,612,874	17	10:04	75	70	72	1,804,352
February..	665:55	584,582	70,734,422	6:05	15,587	857,285	.....	.....	.....	71,591,707	2,556,847	7	1:44	70	70	70	276,848
March.....	720:10	681,584	76,726,051	56:40	104,717	5,759,435	.....	.....	.....	82,485,486	2,660,822	8	18:07	80	70	78	4,099,160
April	708:35	618 574	70,760,077	15:25	33,813	1,804,715	.....	.....	.....	72,564,792	2,418,826	16	11:55	80	70	75	2,184,228
May.	744	585,468	69,670,692	.....	.....	.....	.....	... .	.....	69,670,692	2,247,442	11	7:17	70	70	70	963,662
June	718:10	620,287	73,814,153	1:50	4,257	234,135	.....	.....	.....	74,048,288	2,468,276	9	3:48	70	70	70	540,855
July.	740:15	680,913	81,028,647	3:45	9,575	526 625	:08	1,655	28,135	81,583,407	2,631,723	13	2:36	70	70	70	501,755
August....	733:29	657,782	78,276,058	10;31	26,924	1,480,820	4:18	22,204	377,468	80,134,346	2,584,979	12	8:51	80	70	76	1,932,316
September	720	694 595	82,656,805	.....	.....	.....	.....	.....	.....	82,656,805	2,755,227	17	8:16	70	70	70	1,390,158
October....	740:55	707,845	84,233,555	3:05	7,528	414,040	.....	.....	.....	84,647,595	2,730,568	16	4:57	70	70	70	778,498
November	720	667,374	79,417,506	.....	.....	.....	.....	.....	.....	79,417,506	2,647,250	5	2 39	70	70	70	432,827
December..	741:35	709,088	84,381,472	2:25	6,620	364,100	.....	.....	.....	84,745,572	2,733,728	13	6:18	80	70	71	1,068,025
Totals ..	8,694:19	7,874,956	932,268,982	102:31	215,831	11,870,705	4:26	23,859	405 603	944,545,290	2,587,795	144	86:32	80	70	73¾	15,972,184

In March the Gaskill engines were run 37¾ hours with the left pump disconnected, making 58,042 revolutions, and 25 hours with the right pump disconnected, making 31,842 revolutions.
In April the right Gaskill engine and pump were run 27¾ hours with the left engine and pump shut down, making 47 903 revolutions.
From January 1st to March 16th the capacity of the Gaskill pumps was 121 gallons per revolution.
From March 18th to March 29th the capacity of the Gaskill pumps was 120 gallons per revolution.
From March 30th to December 31st the capacity of the Gaskill pumps was 119 gallons per revolution.
The greatest quantity of water pumped in one day was 4,421 982 gallons, March 31st.
The least quantity of water pumped in one day was 2,131,528 gallons, May 30th.

The quantity of water pumped each year since the works commenced operations has been as follows :

1873	142,477,725 gallons.	1886	779,761,852 gallons.
1874	294,714,798 gallons.	1887	827,195,009 gallons.
1875	416,756,579 gallons.	1888	872 990,164 gallons.
1876	518,197,129 gallons.	1889	944,472,747 gallons.
1877	538,847,186 gallons.	1890	988,771,453 gallons.
1878	530,197,397 gallons.	1891	1 014,475,021 gallons.
1879	672 344 128 gallons.	1892	962 953,662 gallons.
1880	827,067,372 gallons.	1893	1,044,256,276 gallons.
1881	944,382 043 gallons.	1894	1,094,735,621 gallons.
1882	775,642 466 gallons.	1895	1,122,363,468 gallons.
1883	773,942,702 gallons.	1896	1,069,523,471 gallons.
1884	831,867,463 gallons.	1897	944,545,290 gallons.
1885	836,970,016 gallons.		

GENERAL MAINTENANCE AND REPAIRS.

The total cost of maintenance and repairs, besides the improvements hereinbefore noted, to-wit: The extension of the breakwater at the bay, $3,825.52, the grading of the engine house grounds, $358.92, and the amount expended for operating the pumping engines, $6,789.56, was as follows :

Salary of superintendent and secretary	$1,611 00	
Salary of office assistant	716 00	
Office expenses	383 82	
Repairs on main distribution	579 52	
Repairs and care of services	468 77	
Repairs and care of water meters	640 97	
Repairs and care of inlet works	564 41	
Service connections	46 77	
Repairs to engine house	29 99	
		$5 041 25

Office Expenses.

The office expenses were :

Heating and lighting	$ 89 32	
Telephone rental at office and part of year at superintendent's house	55 00	
Blank books, stationery and printing	118 75	
Postage stamps and postal cards	62 90	
Accountant examining books	35 00	
Directory and atlas	15 25	
Ice, repairs, etc	7 60	
		$ 383 82

Repairs on Main Distribution.

The repairs on main distribution were:

Labor examining testing and repairing hydrants	$ 103 12	
Parts of hydrants from manufacturers for repairs	25 46	
Shop repairs on hydrants	25 28	
Repairs valves and replacing wood valve boxes with iron	112 57	
Labor repairing 49 leaks in main pipe	166 69	
Pipe for repairing 11 burst pipe	44 92	
Changing pipes for sewers and raising hydrants to grade	49 80	
Leveling trenches, tools, street car fares, etc	52 18	
		$ 579 52

The number of leaks in the main pipes during the year was 49, of which one was in a lead joint on cast iron pipe, and 48 were in Wyckoff pipes. Number of burst pipe, 11; knots, 1; joint leaks, 36.

Six main pipes have been raised to make way for sewers, where they were being laid on the same grade as the water pipe.

Repairs and Care of Services.

The repairs and care of services were:

Labor shutting and turning on	$ 290 37	
Examining services and notifying consumers	87 25	
Repairing 7 breaks in private mains	41 03	
Repairs on service boxes	7 12	
Changing and replacing service connections	16 75	
Locating stop boxes tools street car fares, etc	26 25	
		$ 468 77

The whole number of services shut off during the year by employes of this department was 389, of which 85 were shut off for non-payment of water rates; 126 were premises found vacant; 158 were shut at the request of the consumer, and 20 were shut for leakage.

The number of services opened by employes of this department was 361.

Seven private mains, supplying several consumers, were found leaking, and repaired by this department without expense to the consumer.

Repairs and Care of Water Meters.

The repairs and care of water meters were :

Monthly inspection and reading	$ 241 75	
Labor on meter repairs	174 75	
Parts from manufacturers for repairs	21 93	
Repairs on meters sent to shop	4 69	
Cleaning and starting meters	72 62	
Repairing meter boxes and lumber	81 63	
Taking out and replacing meters	19 50	
Tools, street car fares, etc	24 15	
		$ 640 97

The number of meters found broken in service during the year was 61, of which 60 were repaired by the inspector, and one was sent to the manufacturers for repairs. The number of meters found not registering properly, but not broken, was 81.

Repairs and Care of Inlet Works.

The repairs and care of inlet works, not including the extension of the breakwaters, were :

Salary of reservoir keeper	$120 00	
Extra labor on repairing banks and cutting grass	122 37	
Tools, lumber, etc	21 34	
Repairing river inlet	70	
		$264 41

The repairs to the banks consisted of regrading the slopes where they were cut by heavy rains when the earth was loose, and raising the rip-rap of broken stone on the inner slopes of the cut.

For Service Connections.

The expenditures were :

48 corporation cocks bought	$18 64	
Labor putting in new taps	23 13	
Re-threading old taps taken out	5 00	
		$46 77

The number of new service connections made with the main pipes during the year was 48. One new connection was

made with a private main, and one branch originally put in, in connection with, and as a part of the main distribution system, and abandoned in 1894, was renewed, and used for private supply to the Eddy-Sheldon company plant. Of the new connections put in, 7 were to replace old connections taken out, and five were for new services to premises before supplied, but the old service was abandoned when the new one was put in.

The number of service connections taken out during the year was 51, 44 of which were heretofore reported abandoned, and the number abandoned but not taken out was 2.

Whole number of service connections in main pipes December 31st, 1897, 2,028.

Whole number of separate services supplied, 2,089.

Service connections put in 1897 :

	6 in. branch	1 in.	¾ in.	⅝ in.	½ in.	Total.
In cast iron mains	1	.....	1	5	7	14
In Wyckoff mains	.....	7	7	9	12	35
Total	1	7	8	14	19	49

Service connections taken out :

	4 in. branch	2 in.	1 in.	¾ in.	⅝ in.	½ in.	Total.
In Wyckoff mains	2	2	7	22	2	16	51

Of these taps taken out, 43 have been heretofore reported as abandoned.

Service connections in main pipes Dec. 31, 1897 :

	Branches.					Corporation Stops.							Totals
	8 in	6 in	4 in	3 in	2 in	2 in	1¼	1 in	¾	⅝	½	⅜	
In cast iron mains.....	1	4	10	3	4	2	4	58	68	72	130	5	361
In Wyckoff mains.....	1	3	14	1	2	2	....	184	431	427	598	6	1 [illegible]
Totals.....	2	7	24	4	6	4	4	242	499	499	726	11	2 [illegible]

The abandoned service connections not taken out are :

	Branches.	Corporation Stops.					Totals.
	4 inch.	1 in.	¾ in.	⅝ in.	½ in.	⅜ in	
In cast iron mains.....	2	8	9	4	11	4	38
In Wyckoff mains.....	1	17	31	12	32	.....	93
Totals.....	3	25	40	16	43	4	131

Appended to this report is the usual summary of statistics and table of uses supplied.

All of which is respectfully submitted.

E. L. DUNBAR,
Superintendent and Secretary.

Summary of Statistics.

REPORT FOR 1897.

Water Works of Bay City, Michigan.
Works built in 1872.
Owned by city.
Source of supply, Saginaw Bay, an arm of Lake Huron.
Mode of supply, direct pumping.

PUMPING.

1. Builders of pumping machinery, Holly Manfg. Co.
2. Coal used, bituminous, slack.
3. Coal consumed for year, 3,181,828 pounds.
4. Wood consumed, $\frac{22,000}{3}$ 7,333 pounds.
5. Total fuel consumed, 3,189,161 pounds.
6. Total pumpage for year, 944,545,290 gallons.
8. Average dynamic head against which pumps work, 113 feet.
9. Number of gallons pumped per pound of coal, 296.
10. Duty $\frac{944,545,290 \times 8.34 \times 100 \times 113}{3,189,161}$ 27,943,348.

    Cost of pumping, based on total pumping station expenses, $6,880.20.
11. Per million gallons pumped, $7.29.
12. Per million gallons raised 100 feet, $6.45.

    Cost of pumping, based on total maintenance, including interest, $41,325.25.
13. Per million gallons pumped, $43.75.
14. Per million gallons raised 100 feet, $38.72.

Financial—Maintenance.

RECEIPTS—DIVISION I.

	From consumers—		
A.	Water rates, domestic	$16,734 09	
B.	Water rates, manufacturing	5,385 19	
C.	Net receipts for water		$22,119 28
D.	Miscellaneous		335 44
	E. Total		$22,454 72
	From public funds—		
J.	Tax levy for interest		$25,310 00
K.	Gross receipts from all sources		47,764 72

DIVISION II.

	From fixed rates—		
L.	Domestic	$10,146 66	
M.	Manufacturing	467 73	
	N. Total		$10,614 39
	From meter rates—		
O.	Domestic	$ 6,587 43	
P.	Manufacturing	4,917 46	
	Q. Total		$11,504 89

EXPENDITURES.

AA.	Management and repairs	$16,015 25	
BB.	Interest on bonds	25,310 00	
CC.	Total maintenance for year		$41,325 25
DD.	Balance to construction		6,439 47
	EE. Total		$47,764 72

Construction.

R.	Balance from previous years	$10,149 61	
	Balance from maintenance	6,439 47	
			$16,589 08
FF.	Extension of mains		$ 3,888 84
HH.	Water meters		530 46
I. I.	Total construction for year		$ 4,369 30
J J.	Balance		12,219 78
			$16,589 08

W. Net cost of works to date $271,078 62

X. Bonded debt $262,000

CONSUMPTION.

1. Estimated population to date, 33,000.
2. Estimated population on pipe lines, 21,000.
3. Estimated population supplied, 15,000.
4. Total gallons supplied, 944,545,290.
5. Passed through domestic meters, 51,807,795 gallons, 5.48 per cent.
6. Passed through manufacturing meters, 47,795,286 gallons, 5.06 per cent.
7. Average daily consumption, 2,587,795 gallons.
8. Gallons per day to each inhabitant, 78.
9. Gallons per day to each consumer, 172.
10. Gallons per day to each service (distribution 22) 1,364.

DISTRIBUTION.—MAINS.

1. Material, cast iron and Wyckoff patent.
2. Size, 3 inch to 20 inch.
3. Extended, 4,403½ feet.
4. Discontinued, 646 feet.
5. Total in use, 44 miles.
6. Cost of repairs per mile, $13.17.
7. Leaks per mile, 1.1.
8. Small distribution less than 4 inch, 319 feet.
9. Hydrants added, 10.
10. Number in use, 403.
11. Stop gates added, 16.
12. Number in use, 678.
13. Number of small gates less than 4 inch, 3.
14. Number of blow off gates, 20.
15. Ranges of pressure (domestic) at center day and night, 35 to 38 pounds.

SERVICES.

16. Material, lead, wrought iron and Wyckoff.
17. Size, $\frac{3}{4}$ inch to 8 inch.
21. Service taps added, 39.
22. Number now in use, 1,897.
25. Meters added, 61.
26. Number in use, 681.

Uses Supplied at Fixed Rates January 1st, 1898.

Automatic Sprinklers	3	Hotels	12
Bakeries	2	Laboratory	1
Banks	1	Laundries	2
Barber Shops	7	Mattress Factory	1
Bath Rooms (public)	1	Meat Ware house	2
Bath Rooms (Turkish)	1	Offices	23
Baths (private)	155	Paint Shop	1
Blacksmith Shops	2	Passenger Depot	1
Boarding Houses	3	Pawn Shop	1
Boilers (power)	4	Photograph Galleries	5
Bottling Works	5	Plumbing Shops	2
Business Blocks	9	Printing Offices	5
Business College	1	Restaurants	6
Butcher Shops	7	Saloons	33
Carriage Shops	3	Schools	15
Canning Works	1	Shoe Shops	1
Chicory Factory	1	Skating Rinks	3
Churches	4	Stables (hotel)	5
Cigar Factories	2	Stables (livery)	5
Clothes Cleaning	2	Stables (mill)	5
Dwellings	591	Stables (private)	70
Express Office	1	Stone Yard	1
Fire Pipe	2	Stores	67
Fish Market	1	Tailor Shop	2
Fountains	1	Telegraph Office	1
Gas Engine	1	Tin Shop	1
Gas Works	1	Undertaker Room	1
Green Houses	2	Water Closets and Urinals	610
Halls (public)	6	Water Closets in Schools	60
Harness Shops	2	Water Motors	2
Hose for sprinkling	249	Ware Houses	2

Uses Supplied Through Meters, January 1st, 1898.

Armory	1	Green Houses	4
Ashery	1	Halls (public)	11
Bakeries	4	Hotels	10
Banks	4	Hose for Sprinkling	399
Barber Shops	2	Laundries	4
Bath Room (public)	1	Locomotive Stand Pipe	1
Baths (private)	365	Locomotive Round House and Tank	1
Bicycle Factory	1	Machine Shops	5
Blacksmith Shop	1	Masonic Temple	1
Boarding Houses	6	Opera House	1
Boilers (power)	41	Offices	30
Boiler Shops	4	Paint Shop	1
Bottling Works	3	Passenger Depots	2
Box Factories	6	Photograph Gallery	1
Brewery	1	Pipe Factory	1
Broom Factory	1	Planing Mills	14
Business Blocks	23	Plumbers' Shop	1
Business College	1	Printing Office	3
Butcher Shop	2	Railroad Coach Yard	1
Carpenter Shop	2	Reel Factory	1
Carpet Cleaning	1	Restaurants	4
Canning Works	1	Saloons	9
Cemetery	1	Salt Blocks	7
Churches	4	Saw Mills	8
Club Rooms	2	Sash and Door Factories	3
Coal and Wood Yards	2	Stable (hotel)	1
County Court House	1	Stables (livery)	8
County Jail	1	Stables (mill)	7
Cracker Factory	1	Stable (omnibus)	1
Cross Arm Factory	1	Stables (private)	80
Crystal Water Works	1	Stables (street car)	1
Drill Houses	3	Stores	50
Dwellings	518	Telegraph Office	1
Electric Light Works	1	Undertaker Room	1
Elevator Tanks	5	Water Closets and Urinals	961
Fire Pipes	20	Water Motor Pumps	65
Flour Mills	2	Ware House	1
Foundries	4	Wooden Ware Works	1
Government Building	1		
Gas Engines	2		

Uses Shut Off January 1st, 1898.

Baths (private)	39	Hotels	14
Bank	1	Hose for Sprinkling	180
Barber Shops	5	Laundry	1
Basement (vacant)	1	Machine Shops	6
Billiard Hall	1	Market Garden	1
Blacksmith Shops	8	Mortar Yard	1
Boarding Houses	4	Offices	6
Boilers (power)	5	Paint Shop	1
Boiler Shops	1	Planing Mill	1
Bottling Works	2	Plow Factory	1
Broom Factory	1	Plumber Shops	2
Business Blocks	2	Printing Offices	2
Butcher Shop	1	Restaurants	2
Carpet Cleaning	1	Shoe Shop	1
Candy Factory	1	Saloons	15
Cemeteries	4	Saw Mills	2
Church	1	Salt Blocks	2
Cooper Shop	1	Shingle Mill	1
Drill Houses	4	Stables (livery)	2
Dry Kiln	1	Stables (mill)	2
Dwellings	249	Stables (private)	26
Dye Works	1	Stores	51
Excelsior Factory	1	Schools	1
Fair Grounds	1	Skating Rinks	1
Fire Pipes	7	Turning Shop	1
Fish Market	1	Vacant Lots	65
Foundries	2	Water Closets and Urinals	111
Halls (public)	4	Water Motors	5
Harness Shops	2	Ware Houses	2

City Uses for Which No Payment Is Made.

1 City Hall.
1 City Building, occupied by Police Station.
1 City Building occupied by Public Library and Water Office.
6 Steamer, Truck and Hose Houses, 20 Horses, 2 Steamers, 1 Chemical
1 Electric Light Station.
30 Water Closets and Urinals in City Buildings.
11 Public Watering Troughs.
4 Ornamental Fountains.
10 Lawn Hose for Sprinkling Parks.
2 Street Sprinkler Carts.
403 Public Fire Hydrants.

VENTY-SEVENTH

ANNUAL REPORT

of the

WATER DEPARTMENT

BAY CITY

MICHIGAN

ECEMBER THIRTY-FIRST

1898.

BAY CITY, MICH.
C. & J. GREGORY CO., PRINTERS.
1899.



Twenty-Seventh

ANNUAL REPORT

—OF THE—

WATER DEPARTMENT

—OF—

BAY CITY, MICHIGAN.

December 31st, 1898.

BAY CITY, MICH.
C. & J. GREGORY CO., PRINTERS.
1899.

Water Department.

1899.

COMMISSIONERS.

SANFORD V. WILKIN, PRESIDENT.
(Term Expired Sept. 6, 1897. No appointment.)

DUNCAN McGREGOR,
(Term Expires Sept. 6th, 1899.)

FREMONT J. TROMBLE,
(Term Expires Sept. 6th, 1900.)

ANDREW WALTON,
(Term Expires Sept. 6th, 1901.)

G. HENRY SHEARER,
(Term Expires Sept. 6th, 1902.)

BENJAMIN F. RAY,
(Term Expires Sept. 6th, 1903.)

(ONE VACANCY.)

OFFICERS AND EMPLOYEES.

E. L. DUNBAR.....Supt. and Secy.
T. A. DELZELL.....Office Assistant.
F. H. COLLINS.....Inspector.
L. D. CARPENTER.....Reservoir Keeper.
THOMAS LARDNER.....Turnkey.
A. B. VERITY.....First Engineer.
JAS. E. DARLING.....Second Engineer.
JAS. H. McGIBBONS.....Fireman.
FRANK O'HARE.....Fireman.

Superintendent's Report.

To the Honorable the Board of Water Works of Bay City, Michigan:

Gentlemen:—I beg leave to submit the report of the Water Department of this city for the year ending December 31st, 1898.

As anticipated in the last annual report of this department, the new industries which have been placed in operation in and near the city during the year, have caused a largely increased demand upon the works. In addition to the 94,000,000 gallons increase in the quantity of water pumped, there has been during the last three months of the year from 500,000 to 800,000 gallons daily taken from the inlet pipe between the bay and the pumping station. The result has been, that, notwithstanding a slight additional rise of the water level in the bay, and the consequent increase in the delivery of the conduit from that source, the river has been called upon to reinforce the supply a total of 82½ hours during the year, as against 36 hours during the last preceding year.

The completion of the improvement to the present inlet works now in contemplation, will overcome this difficulty to some extent, but it is evident that any additional increase in the quantity of the supply that we may possibly secure through the present inlet will be more than offset by the additional

increase in the demand upon the works before the end of the present year, due to the new sugar factory now being erected on the line of the inlet pipe, and the increase in the capacity of the works of The North American Chemical Co., at the south end of the city.

Either a new inlet from the bay of larger capacity than the one now in use, or a considerable increase in the quantity of water taken from the river, will soon be necessary, and I reiterate the recommendation of former years—that the new inlet, when constructed, should bring the supply from the west side of the bay.

The improvements to the works during the year have consisted of laying an 8-inch cast iron main pipe on both sides of Center avenue, from the alley between Water and Saginaw streets to Johnson street, and a 6-inch cast iron main on the west side of Water street, from Center avenue to Sixth street. The pipe on Center avenue was rendered necessary by reason of the new brick pavement on concrete foundation, put in on that avenue. It was not thought advisable to leave the old mains in service, as they had been in use 24 years and were causing some trouble by reason of leaks.

One of the boilers at the pumping station, No. 3, placed in service in 1874, has been replaced with a new one.

The total quantity of water pumped during the year was 1,038,794,253 gallons; an increase over 1897 of 94,247,963 gallons.

About 25,000,000 gallons were supplied to the works of The North American Chemical Co. The balance of the increase is due to the large quantity of water used in laying Center avenue pavement, and to a considerable extent to leakage from the mains; several hidden leaks were found during the latter part of the year, where the water was making its way into the sewers, without appearing at the surface.

Forty-five meters have been added to the number in service at the beginning of the year, making whole number now in service 726.

The total amount of water rates charged on the roll for 1898 was $22,766.61, an increase of $403.42 over the year 1897. The amount collected is a little less than in 1897; the amount uncollected on the roll of 1898 at the close of the year being $1,559.05. This amount is $389.94 more than was uncollected at the close of the year 1897 on the roll for that year, and the amounts collected during the year 1898 on previous years' rolls was $100.75 less than in 1897.

The requirements for the year 1899 are: The replacing of No. 2 boiler at the pumping station by a new one; cleaning out the inlet cut at the bay between the inlet basin and the end of the breakwaters, and the renewal of a section of the breakwaters on the north side of the inlet basin; the renewal of the main pipes on such streets as may be paved during the year, especially if the pavement is placed on concrete foundation; and the renewal of the main pipes in the alley between Jefferson street and Madison avenue, from Second street to Tenth street, and in Harrison street from Cass avenue to the works of The North American Chemical Co.

The extension of the main distribution system to any new streets will be impracticable, unless it is rendered necessary by the laying of new pavements. As all pavements in the city will probably hereafter be laid on concrete foundation, their construction should be anticipated at least one year, by placing the water system on those streets in the best and most durable condition possible.

Under the ordinance now in force, consumers are required to pay all expenses of connecting their service pipes with the mains without reference to its location. As nearly all of the

main pipes are on one side of the street, this renders it much more expensive for the property one side of the street to secure a supply of water than on the other. This is certainly an injustice and there appears to be but one way to overcome it. The city should put in all services to the property line, charging a uniform price, sufficient to cover the cost from the center of street. While this would increase the work of the department somewhat, and render it necessary for the city to carry a stock of lead pipe, stop-cocks and stop-cock boxes, the actual expense would be borne by the consumer, and the result would be more uniformity in the location of the stop boxes, and as the work would not be open to competitive bids, but would be done by direct employes of the city, it would be our own fault if the workmanship and material were not of the best possible to procure.



FINANCIAL.

Receipts.

The receipts of the department for the year have been $ 22,370.18, from the following sources:

From water rates roll of 1893	$ 6 00	
From water rates roll of 1894	45 20	
From water rates roll of 1895	21 93	
From water rates roll of 1896	58 84	
From water rates roll of 1897	690 08	
From water rates roll of 1898	21,207 56	
Total from water rates		$22,029 61
From plumbers' licenses	$ 35 00	
From service connections	184 02	
From repairs on main distribution	31 86	
From repairs and care of water meters	2 00	
From setting meters	2 00	
From furniture and fixtures	3 00	
From cast iron pipe sold	52 48	
From valves and valve boxes sold	24 90	
From laying pipe account	5 31	
Total miscellaneous		340 57
Total receipts		$22,370 18

Receipts by months:

January	$ 1,036 97
February	479 60
March	1,105 44
April	1,810 32
May	770 34
June	1,477 78
July	1,834 08
August	869 11
September	1,534 81
October	2,422 60
November	1,452 22
December	7,576 91
	$22,370 18

The receipts have been deposited with the City Treasurer on the last day of each month as per receipts on file.

Expenditures.

The expenditures of the department for the year have been $21,730.53, of which $12,733.70 was for maintenance and operating expenses, and $8,996.83 for construction.

FOR MAINTENANCE ACCOUNT.

Office department:

Superintendent and secretary's salary	$1,710 00
Office assistant	760 00
Office expenses	512 47

Street and service department:

Repairs on main distribution	552 26
Repairs and care of services	371 14
Repairs and care of water meters	775 69
Repairs and care of inlet works	585 71
Service connections	102 67

Pumping department:

Engineers' and firemen's wages	3,508 75
Fuel account	2,474 02
Oil, packing and supplies	299 70
Repairs on engines and boilers	800 09
Repairs to boiler arches	248 42
Repairs to engine house and grounds	102 78
Total for maintenance accounts	$12,733 70

FOR CONSTRUCTION ACCOUNTS.

Water meter account:

Water meters	962 62
Setting meters	36 28

Main distribution:

Cast iron pipe and branches	3,251 36
Valves and valve boxes	629 20
Fire hydrants	51 00
Laying pipe	4,066 37
Total for construction account	$8,996 83
Total expenditures	$21,730 53

ACCOUNT WITH CITY WATER WORKS FUND.

	Dr.	Cr.
Balance in Water Works fund Jan. 1st, 1898	$12,219 78	
To cash collections deposited with City Treasurer	22,370 18	
By Recorder's warrants Nos. 347 to 358 inclusive		$21,730 53
Balance in Water Works fund Dec. 31st, 1898		12,859 43
	$34,589 96	$34,589 96

ACCOUNT WITH CITY TREASURER AS TREASURER OF BOARD.

	Dr.	Cr.
To Recorder's warrants Nos. 347 to 358 inclusive	$21,730 53	
By paid orders of Secretary of Board Nos. 4294 to 4760		$21,730 53
	$21,730 53	$21,730 53

Water Rates.

The total amount charged on the roll for 1898 was:

For water supplied at fixed rates	$10,316 28
For water supplied through meters	12,450 33
	$22,766 61

The amounts collected on roll of 1898 were:

From fixed rates	$ 9,781 01
From metered water	11,426 55
	$21,207 56

The amounts uncollected on the roll of 1898 Dec. 31st, were:

From fixed rates	$ 535 27
From metered water	1,023 78
	$ 1,559 05

The amounts collected during the year 1898 from previous years' rolls were:

From fixed rates	$ 284 45
From metered water	537 60
	$ 822 05

The total amount collected on all rolls was:

From fixed rates, domestic	$ 9,338 43
From metered water, domestic	7,309 85
From fixed rates, manufacturing	727 03
From metered water, manufacturing	4,654 30
	$22,029 61

The total amount of water rates collected and uncollected on each year's roll since the works commenced operations has been as follows:

YEAR	COLLECTED.	UNCOLLECTED.	TOTAL ON ROLL
1873, January 1st to April 30th	$ 728 82	$	$ 728 82
1873-4, May 1st, 1873, to April 30th, 1874	5,440 80	1 60	5,442 40
1874-5, May 1st, 1874, to April 30th, 1875	6 908 16	44 85	6 953 01
1875, May 1st, to Dec. 31st	7,269 55	28 46	7,298 01
1876	9,571 26	82 73	9 653 99
1877	9,604 26	134 19	9,738 45
1878	10,078 15	321 71	10,402 86
1879	11,708 97	136 07	11,845 04
1880	13,155 74	120 25	13,275 99
1881	15,002 61	212 40	15,215 01
1882	17,352 47	158 85	17,511 32
1883	18,713 46	98 64	18,812 10
1884	18,892 02	129 89	19,021 91
1885	19,716 73	269 58	19,986 31
1886	19,356 61	118 74	19,475 35
1887	19,436 25	87 00	19,523 25
1888	21,278 62	120 80	21,399 42
1889	22,120 47	113 03	22,233 50
1890	23,297 81	202 81	23,500 62
1891	24,619 51	286 35	24,905 86
1892	24,185 81	280 32	24,466 13
1893	23,658 69	501 44	24,160 13
1894	22,836 60	530 66	23,367 26
1895	22,913 96	318 84	23,232 80
1896	23,098 11	344 02	23,442 13
1897	21,886 56	476 63	22,363 19
1898	21,207 56	1,559 05	22,766 61
Totals	$ 454,039 56	$ 6,681 91	$ 460 721 47

Bonds and Interest.

The annual interest on outstanding Water Works bonds amounting to $24.470, has been paid by the City Treasurer from moneys raised by tax levy, making total amount paid by the city to date on account of interest on Water Works bonds since first issue was made $735,565. $18,000 of bonds issued in 1872 and 1874 became due in October, 1898. These bonds were paid from the proceeds of $18,000 of refunding bonds issued Oct. 15th, 1898, payable Oct. 15th, 1928, and bearing interest at the rate of 4 per cent. per annum.

The total amount of bonds issued by the city for the construction of water works has been $452,000, of which $377,000

were issued in 1871, 1872, 1873, 1874 and 1875, bearing interest at 8 per cent. per annum. $75,000 were issued in 1891, bearing interest at 5 per cent. per annum.

Of the 8 per cent. bonds, $90,000 have been paid and $78,000 have been refunded at 4 per cent. interest.

Total Water Works bonds now outstanding $362,000, of which $209,000 bear interest at 8 per cent. per annum; $75,000 at 5 per cent and $78,000 at 4 per cent.

$10,000 of the 8 per cent bonds are due February 16th, 1899, and will be paid, the money being now in the city treasury.

Bonds Outstanding Dec. 31st, 1898.

Series.	Date of Issue.	Date Payable.	Amount.	Interest.
No. 13	August 15, 1872	Feb'y. 16, 1899	$ 10,000 00	8 per cent
" 14	" " "	" " 1900	10,000 00	"
" 15	" " "	" " 1901	10,000 00	"
" 16	" " "	" " 1902	10,000 00	"
" 17	" " "	" " 1903	10,000 00	"
" 18	" " "	" " 1904	9,000 00	"
" 19	August 15, 1873	" " 1905	10,000 00	"
" 20	" " "	" " 1906	10,000 00	"
" 21	" " "	" " 1907	10,000 00	"
" 22	" " "	" " 1908	10,000 00	"
" 23	" " "	" " 1909	10,000 00	"
" 24	Feb'y. 15, 1874	" " 1910	10,000 00	"
" 25	April 15, 1874	April 15, 1911	10,000 00	"
" 26	" " "	" " 1912	10,000 00	"
" 27	" " "	" " 1913	20,000 00	"
" 33	March 1, 1875	March 1, 1900	10,000 00	"
" 34	" " "	" " 1901	10,000 00	"
" 35	June 1, 1875	June 1, 1902	10,000 00	"
" 36	" " "	" " 1903	10,000 00	"
" 37	" " "	" " 1904	10,000 00	"
Not Serled.				
Nos. 1 to 25	May 1, 1891	May 1, 1905	25,000 00	5 per cent.
Nos. 26 to 50	" " "	" " 1911	25,000 00	"
Nos. 51 to 63	" " "	" " 1917	12,500 00	"
Nos. 64 to 76	" " "	" " 1918	12,500 00	"
Refunding.				
Nos. 1 to 20	Oct. 1, 1895	Oct. 1, 1920	20,000 00	4 per cent.
Nos. 1 to 20	Oct. 1, 1896	" " 1921	20,000 00	"
Nos. 1 to 20	Oct. 15, 1897	Oct. 15, 1927	20,000 00	"
Nos. 1 to 18	Oct. 15, 1898	" " 1928	18,000 00	"
			$ 362,000 00	

Balance Sheet—Bay City Water Works, 1898.

		Dr.	Cr
Folio 257,	Water rates, Roll of 1886		$ 6 10
" 257,	Water rates, Roll of 1894		45 30
" 257,	Water rates, Roll of 1895		21 93
" 257,	Water rates, Roll of 1896		58 84
" 256,	Water rates, Roll of 1897		690 06
" 255,	Water rates, Roll of 1898		21,307 56
" 258,	Plumbers' licenses		35 10
" 266,	Service connections		81 35
" 275,	Furniture and fixtures		3 00
" 259,	City Water Works fund	$ 639 65	
" 260,	Office department salaries	2,470 00	
" 267,	Office department expenses	512 47	
" 322,	Street and service dept., repairs on main distribution	520 40	
" 263,	Street and service dept., repairs and care of service	371 14	
" 322,	Street and service dept., repairs and care of water meters	773 69	
" 265,	Street and service dept., repairs and care of inlet works	585 71	
" 267,	Pumping department, salaries of engineers and firemen	3,508 75	
" 268,	Pumping department, fuel	2,474 02	
" 269,	Pumping department, oil, packing and supplies	239 70	
" 272,	Pumping department, repairs on engines and boilers	800 09	
" 272,	Pumping department, repairs to boiler arches	248 42	
" 271,	Repairs to engine house and grounds	102 78	
" 273,	Water meter account, new meters	962 62	
" 273,	Water meter account, setting meters	34 28	
" 274,	Main distribution, cast iron pipe	3,198 88	
" 274,	Main distribution, valves	604 30	
" 275,	Main distribution, fire hydrants	51 00	
" 277,	Main distribution, laying pipe	4,061 06	
		$22,148 96	$22,148 96

Ledger Balances—December 31st, 1898.

LEDGER E.			Dr.	Cr.
Folio 1.	Bay City bond account ($452,000 bonds)			$ 443,045 87
" 1.	Water assessment frontage on pipe			736 07
" 25.	Water rates			454,039 56
" 22.	Plumbers' licenses			895 20
" 21.	Rents, dockage, etc			2,627 33
" 23.	Service taps and service boxes			3,560 84
" 2.	Construction—real estate		$ 6,724 83	
" 2,	"	dock, tramway and store shed	1,882 63	
" 3,	"	engine house, chimney and wells	21,401 42	
" 3,	"	engine foundations, boiler foundations and arches	6,777 45	
" 4,	"	pumping machinery	59,427 72	
" 4,	"	inlet from Saginaw river	4,799 46	
" 5,	"	inlet from Saginaw bay	84,778 37	
" 5,	"	reservoir, breakwater, etc	24,713 78	
" 26,	"	iron pipe and branches	113,795 00	
" 6,	"	Wyckoff patent pipe	126,441 31	
" 26,	"	valves for street mains	16,583 81	
" 27,	"	public fire hydrants	15,387 27	
" 27,	"	laying pipe	63,573 13	
" 8,	"	buildings at bay	452 46	
" 12,	"	water meters	18,131 82	
" 9,	"	furniture and fixtures	987 96	
" 10,	"	implements	1,713 61	
" 10,	"	engineering and general superintendence	7,856 17	
" 11,	"	traveling expenses	306 29	
" 11,	"	insurance	29 00	
" 12,	"	interest, discounts and commissions	4,224 17	
" 29.	Maintenance,	office expenses and salaries	63,039 22	
" 29,	"	repairs and care of hydrants, valves, and pipes	19,453 96	
" 30,	"	repairs and care of water meters	6,136 14	
" 30,	"	repairs and care of inlet works	34,666 88	
" 31,	"	repairs to engine house, etc	3,543 20	
" 15,	"	repairs to dock	13 38	
" 32,	"	engineer's and firemen's wages	91,690 90	
" 32,	"	fuel	69,477 89	
" 33,	"	oil, packing and supplies	9,689 70	
" 33,	"	repairs to pumping machinery	7,934 23	
" 18,	"	repairs to engine foundations	51 46	
" 18,	"	repairs to boiler arches	1,521 61	
" 19,	"	implement account	1,129 37	
" 19,	"	interest	3,709 84	
" 20.	City Water Works fund		12,859 43	
			$904,904 87	$904,904 87

SOURCE OF SUPPLY.

Nothing has been done during the year towards the completion of the improvements to the inlet works at the bay, but the year's experience has demonstrated the necessity for immediate action towards the cleaning of the inlet cut.

In February, a heavy southwest wind lowered the water in the bay to such an extent, that none came into the inlet cut; pumping the supply for the city from the basin and cut lowered the water to such an extent that the ice settled to the ground, and remained there such a length of time, that, (the weather being extremely cold,) the ice was cemented to the bottom and formed a perfect dam. When the wind subsided and the water rose in the bay to its normal level, none entered the basin, and it became necessary to cut a channel through the ice several hundred feet in length, before any water could be admitted. While this work was in progress it became necessary to draw a portion of the supply from the river, and for 27 hours at this time the river valve was partially open.

The river inlet has been called upon a total of 82½ hours during the year to help out the supply, of which 38½ hours was for fire service and 44 hours were when there was no extra demand upon the works, but the supply from the bay was insufficient for the ordinary domestic service.

River Valve Open—1898.

January 29, fire, 30 minutes, 6 turns.
February 4-5, low water, 27 hours, 4 turns.
April 15, fire, 5 hours, 30 minutes, 15 turns.
" 19, fire, 40 minutes, 5 turns.
" 20, fire, 1 hour, 15 minutes, 10 turns.
May 9, fire, 40 minutes, 5 turns.
" 13, fire, 1 hour, 30 minutes, 10 turns.
June 29, fire, 2 hours, 10 turns,
July 2, fire, 15 minutes, 10 turns.
" 12, fire, 5 hours, 30 minutes, 10 turns.
" 18, fire, 20 minutes, 10 turns.
" 30, fire, 40 minutes, 6 turns.
September 3, fire, 3 hours, 20 minutes, 10 turns.
" 4, fire, 7 hours, 30 minutes, 15 turns
October 4, fire, 1 hour, 6 turns.
" 19, fire, 3 hours, 30 minutes, 10 turns.
November 12, fire, 20 minutes, 5 turns.
" 22-23, low water, 14 hours, 8 turns.
December 7, low water, 3 hours 3 turns.
" 10, fire, 2 hours, 10 minutes, 10 turns.
" 16, fire, 40 minutes, 10 turns.
" 17, fire, 1 hour, 10 minutes, 6 turns.
Total—22 times, 82 hours, 30 minutes; Average, 8 turns.
44 hours for low water. 38½ hours for fire service.

MAIN DISTRIBUTION.

There has been no extension of the distributing system to additional streets during the year, the work in this branch being confined to the renewal of the pipes on both sides of Center avenue, from the alley between Water and Saginaw streets to Johnson street, and on Water street from Center avenue to Sixth street, and a short extension of the pipe supplying the fire hydrant at the corner of Columbus avenue and the Tuscola road, rendered necessary by the change in the lines of Columbus avenue at this point.

The total length of pipe laid during the year was:

10-inch cast iron	228 feet
8-inch cast iron	9,781 feet
6-inch cast iron	1,376½ feet
4-inch cast iron	79½ feet
4-inch Wyckoff patent	35 feet
Total	11,500 feet

The length of pipe taken out or abandoned was:

10-inch cast iron	7½ feet
8-inch cast iron	24½ feet
6-inch cast iron	166½ feet
4-inch cast iron	47 feet
10-inch Wyckoff patent	123½ feet
8-inch Wyckoff patent	1,650 1-6 feet
6-inch Wyckoff patent	8,187 feet
4-inch Wyckoff patent	1,084½ feet
Total	11,390 5-6 feet

The total length of distributing mains in service December 31st, 1898, 232,275 11-12 feet.

The number of stop valves set in the distributing system during the year was:

10-inch Flower patent	5
8-inch Flower patent	7[illegible]
6-inch Flower patent	2[illegible]
4-inch Flower patent	1[illegible]
Total	6[illegible]

The number of valves taken out was:

10-inch Flower patent	3
8-inch Flower patent	4
8-inch Galvin patent	1
6-inch Flower patent	20
6-inch Galvin patent	1
4-inch Flower patent	22
4-inch Galvin patent	2
Total	53

Abandoned and not taken out:

4-inch Flower patent	1

Total number of valves in service December 31, 1898, 687.

The number of fire hydrants set during the year was 12, of the following described pattern:

Matthews	4
Holly	7
Gaskill	1

The number of fire hydrants taken out was 11, as follows:

Matthews	1
Holly	8
Gaskill	1
Brown	1

Total number of public fire hydrants in service December 31, 1898, 404.

The hydrant added is located on the N. W. corner of Sixth and Water streets.

The number of hydrants on Center avenue is the same as before, but the location of part of them were changed as follows:

The hydrant formerly located near the alley between Adams and Jefferson streets was changed to the N. E. corner of Center and Adams, and a Matthews hydrant substituted for a Holly.

The Brown hydrant formerly located at the S. E. corner of Center avenue and Monroe street was discontinued, and a Matthews hydrant placed at the N. E. corner of same streets.

The Holly hydrant formerly located at the N. W. corner of Center avenue and Sheridan street was removed to the N. E. corner of the same streets.

The Holly hydrant formerly located at the S. W. corner of Center avenue and McLellan street was removed to the N. E. corner of Center avenue and Hampton street.

The Holly hydrant located on the S. W. corner of Center avenue and Farragut street was taken out and a Matthews hydrant placed at the N. E. corner of the same streets.

Main pipe in service December 31st, 1898:

	Cast Iron.	Wyckoff	Total
20 inch	9,563 ft		9,563 ft
16 inch	13,778 "		13,778 "
12 inch	9,083 "		9,083 "
10 inch	11,327 "	27,911 ft	39,238 "
8 inch	15,035½ "	23,566 1-12 "	38,601 5-12 "
6 inch	18,121½ "	81,499 "	99,620½ "
4 inch	1,531¾ "	20,541¼ "	22,073 "
3 inch		319 "	319 "
Total	78,439 7-12 ft	153,836 4-12 ft	232,275 11-12 ft

Total cast iron mains	14 miles,	4,519 7-12 feet
Total Wyckoff mains	29 miles,	716 4-12 feet
Total mains	43 miles,	5,235 11-12 feet

Percentage of each size of pipe:

20 inch	4.12 per cent.
16 inch	5.94 per cent.
12 inch	3.91 per cent.
10 inch	16.88 per cent.
8 inch	16.62 per cent.
6 inch	42.89 per cent.
4 inch	9.50 per cent.
3 inch	.14 per cent.
	100.00

Valves in service December 31st, 1898:

	20 in.	16 in.	12 in.	10 in.	8 in.	6 in.	4 in.	3 in.	Total.
Flower Patent	4	9	3	37	56	178	335	3	625
Galvin's Patent			2			4	43		49
Brown Patent			1			1			2
Eddy Patent						5	6		11
Total	4	9	6	37	56	188	384	3	687

Blow-off gates included in the above:

Three .....6 inch.
Eleven..... .... 4 inch.
Two..... .....3 inch.

Fire hydrants in service December 31st, 1898:

Matthews, 6 inch inlet, 3 hose nozzles, gated	32
Matthews, 4 inch inlet, 2 hose nozzles	204
Bourbon, 6 inch inlet, 3 hose nozzles, gated	5
Bourbon, 4 inch inlet, 2 hose nozzles	10
Holly, 4 inch inlet, 2 hose nozzles, gated	4
Holly, 4 inch inlet, 2 hose nozzles	128
Gaskill, 4 inch inlet, 2 hose nozzles	16
Galvin, 4 inch inlet, 2 hose nozzles	4
Morgan, 4 inch inlet, 2 hose nozzles	1
	404





WATER METERS.

The number of water meters set during the year was 61 and the number of meters taken out was 16, making whole number of meters in service December 31st, 1898, 726, of which 101 are classed as manufacturing meters and 625 are classed as domestic.

The total amount expended during the year on the extension of meter system was:

For 55 new meters bought	$962 62
For meter fittings and setting meters	36 28
	$998 90

The new meters bought are:

1 6 inch Union Rotary, cost with freight	$459 09
15 ⅝ inch Empire, AA, cost with freight	157 29
10 ⅝ inch Empire, A, cost with freight	105 35
12 ⅝ inch Columbia	96 56
5 ⅝ inch Hersey Disc	42 56
12 ⅝ inch Lambert	101 77
	$962 62

The total cost of the meter system to December 31, 1898, was:

726 meters in service, cost set	$15,861 90
50 meters in stock, cost	1,342 19
Meter fittings in stock	70 37
Labor, etc., on 105 meters permanently removed	857 36
	$18,131 82

Meters bought, 1898:

	6 in.	⅝ in.	Total.
Union Rotary	1		1
Columbia		12	12
Empire AA		15	15
Empire A		10	10
Hersey Disc		5	5
Thomson Lambert		12	12
Total	1	54	55

Meters taken out, 1898:

	3 in.	2 in.	1 in.	¾ in.	⅝ in	½ in.	⅜ in.	Total
Union Rotary	1	1	1					3
Union Duplex					1			1
Crown			2	3		1	1	7
Worthington		1						1
Thomson					3			3
Thomson Bee						1		1
Total	1	2	3	3	4	2	1	16

Meters in stock January 1st, 1898:

	3 in.	1½ in.	1 in.	¾ in.	⅝ in.	½ in	Total
Union Rotary	4			1			5
Union Duplex					3		3
Crown			3				3
Empire			3	3		5	11
Empire AA					3		3
Worthington		2					8
Hersey					1		1
Thompson				2	4		6
Thomson Bee						1	1
Thomson Lambert					3		3
Westinghouse					2		2
Total	4	2	6	6	16	6	40

Meters set in 1898:

	6 in.	2 in.	1 in.	¾ in.	⅝ in	Total
Union Rotary	1					1
Union Duplex					1	1
Columbia					12	12
Crown			3	1		4
Empire A					5	5
Empire AA					16	16
Worthington		1				1
Hersey					1	1
Hersey Disc					4	4
Thomson					2	2
Thomson Lambert					14	14
Total	1	1	3	1	55	61

Meters in stock December 31st, 1898:

	3 in.	2 in.	1½ in	1 in.	¾ in.	⅝ in.	½ in	⅜ in	Total
Union Rotary	5	1	....	1	1	.....	....	.....	8
Union Duplex	.....	.....	.....	.....	.....	3	.....	.....	3
Crown	.. ..	.....	.....	2	2	....	1	1	6
Empire	.....	.....	.....	3	3	.....	5	.....	11
Empire A	.....	.....	.....	.....	.....	5	.....	.....	5
Empire AA	.....	.....	.....	.....	.....	2	.....	.....	2
Worthington	.....	.....	2	.....	.....	.....	.....	.....	2
Hersey Disc	.....	.. ..	.....	.....	.....	1	.....	.....	1
Thompson	.....	.....	.....	.....	2	5	.....	.....	7
Thomson Bee	.....	.....	.....	.....	.....	.....	2	.....	2
Thomson Lambert	.....	.....	.....	.....	.....	1	.....	.....	1
Westinghouse	.....	.....	.....	.....	.....	2	.....	....	2
Total	5	1	2	6	8	19	8	1	50

Meters in service December 31st, 1898:

	8 in	6 in	4 in	3 in	2 in	1½ in	1 in.	¾ in.	⅝ in	½ in.	⅜ in.	Total
Union Rotary	1	1	6	16	5	4	2	....	42	.....	.....	77
Union Duplex	.....	.....	.....	.....	.....	.....	.....	.....	19	.....	.....	19
Columbia	.. ..	...	.....	.....	.....	.....	.....	.....	23	.....	.....	23
Crown	.....	.....	.....	.....	.....	1	23	32	.....	27	41	124
Empire	.. ..	.....	.....	.....	.....	.....	3	32	.....	20	.....	55
Empire A	.....	.....	.....	.....	.....	.....	.....	.....	5	.....	.....	5
Empire AA	...	.....	.....	.....	.....	.....	.....	.....	38	.....	.....	38
Nash	.....	.....	.....	.....	.....	.....	.....	..	20	.....	.....	20
Gem	.....	...	.....	.....	1	.....	.....	.....	.....	.....	.....	1
Worthington	.....	.....	.....	....	7	4	.....	.....	16	.....	.....	27
Hersey	.....	..	..	.....	...	.....	2	5	26	.....	.....	33
Hersey Disc	.....	.....	.....	.....	.....	.....	.....	.....	30	.....	.....	30
Thomson	.....	.....	.....	.....	.....	.....	2	.....	97	.....	.....	99
Thomson Bee	.....	.	.....	.....	..	.....	.....	.....	18	70	.....	88
Thomson Lambert	.....	.....	.....	.....	.....	.....	.....	.. ..	23	.....	.....	23
Trident	.....	.....	.....	.....	.....	.....	.....	.....	60	.....	.....	60
Westinghouse	.....	.....	.....	.....	.....	.....	.....	.....	4	.....	.....	4
Total	1	1	6	16	13	9	32	69	421	117	41	726



PUMPING STATION.

One of the old boilers (No. 3) placed in service in 1874. has been replaced during the year by a new one of the same dimensions; 16 feet long, and 5½ feet in diameter. The number and size of tubes are not the same; the old boiler contained 105 tubes, 2¾ inches interior diameter. The new boiler contains 64 tubes 3¾ inches interior diameter. The cost of the new boiler, including cost of rebuilding arch, and such new connections as were necessary, was $808.62.

The total amount expended during the year for operating the pumping engines, including the cost of replacing the boiler above mentioned, was:

For salaries of engineers and firemen	$ 3,508 75
For fuel	2,474 02
For oil, packing and engineer's supplies	229 70
For repairs on engines and boilers	800 09
For repairs to boiler arches	248 42
	$ 7,260 98

The fuel used was coarse slack coal from the mines in the township of Monitor in this county, except 3 cars of lump coal from the same mines, and 2 cars of lump coal and 2 cars of coarse slack from the mines in Saginaw county.

The total quantity of coal purchased during the year was:

3,265,800 lbs. Monitor slack @ $1.25 per ton	$ 2,041 15
82,600 lbs. Saginaw slack @ $1.50 per ton	61 96
124,400 lbs. Monitor lump @ $1.95 per ton	121 29
95,100 lbs. Saginaw lump @ $2.00 per ton	95 10
Unloading coal from cars to bins	154 52
	$ 2,474 02

The quantity of fuel on hand at the commencement of the year was:

36 cords of wood cost	$ 18 00
94,120 lbs. slack coal cost	62 59
25,890 lbs. lump coal cost	26 28
	$ 106 87

The quantity of fuel on hand at the close of the year was:

25 cords wood cost	$ 12 50
30,115 lbs. slack coal cost	20 33
10,800 lbs. lump coal cost	10 96
	$ 43 79

Total quantity of fuel consumed during the year:

11 cords wood cost	$ 5 50
3,412,405 lbs. slack coal cost	2,291 29
234,590 lbs. lump coal cost	240 31
	$ 2,537 10

The net cost of operating the pumping engines was:

Engineer's and firemen's wages	$ 3,503 75
Fuel	2,537 10
Oil, packing and supplies used	231 17
Repairs on engines, boilers and arches	1,048 51
Total	$ 7,325 53

The right Gaskill engine and pump were run 8,699 23-60 hours and the left Gaskill engine and pump 8,625 38-60 hours. The quantity of water pumped by the Gaskill engines was 1,028,255,795 gallons.

The quadruplex engines and pumps were run 74 52-60 hours, pumping 10,039,865 gallons.

The high pressure engine and rotary pumps were run 7 10-60 hours, pumping 498,593 gallons.

The total quantity of water pumped during the year was 1,038,794,253 gallons, a daily average of 2,846,012 gallons.

Of the total water pumped, 18,027,413 gallons were pumped against an average fire pressure of 72½ lbs. per square

inch, and 1,020,766,840 gallons were pumped against a domestic pressure of 40 lbs. per square inch. The average lift of all water pumped from the surface of the water in the wells was 113 feet.

The works were run under fire pressure a total of 96 35-60 hours.

The cost of pumping based on net cost of operating pumping engines, $7,325.23, was:

Per million gallons pumped	$ 7 06
Per million gallons raised 100 feet	6 24

The cost of fuel was:

Per million gallons pumped	$ 2 44
Per million gallons raised 100 feet	2 16

The pumping plant consists of

BOILERS.

Five in number, all horizontal tubular boilers, set in separate brick arches. Two boilers are 16 feet long, 66 inches in diameter, each containing 105 tubes 16 feet long and $2\frac{3}{4}$ inches interior diameter. One boiler is 16 feet long, 66 inches in diameter, with 64 tubes $3\frac{3}{4}$ inches interior diameter. Two boilers are 16 feet long, 60 inches in diameter, each containing 48 tubes $3\frac{3}{4}$ inches interior diameter.

The area of grate surface under each boiler is: No. 1. $27\frac{1}{2}$ square feet; No. 2, 34 square feet; No. 3, $24\frac{3}{4}$ square feet; Nos. 4 and 5, each $22\frac{1}{2}$ square feet.

Heating surface: Nos. 1 and 2, each ($\frac{1}{2}$ shell 138 24-100 square feet, entire tubes 1,209 51-100 square feet) 1,347 75-100 square feet; No. 3 ($\frac{1}{2}$ shell 138 24-100 square feet, entire tubes 1,005 31-100 square feet) 1,143 55-100 square feet; Nos. 4 and 5, each ($\frac{1}{2}$ shell 125 66-100 square feet, entire flues 753 98-100 square feet) 879 64-100 square feet.

ENGINES AND PUMPS.

One Gaskill horizontal compound condensing crank and fly wheel pumping engine; maximum capacity, 5,000,000 gallons in 24 hours.

One Holly quadruplex compound condensing crank and fly wheel pumping engine; maximum capacity, 3,000,000 gallons in 24 hours.

One horizontal high pressure piston engine, driving through gears two No. 10 Holly rotary pumps; maximum capacity, 2,500,000 gallons in 24 hours.

Capacity of Gaskill pumps per revolution, 119 gallons.

Capacity of quadruplex pumps per revolution, 55 gallons.

Capacity of rotary pumps (2) per revolution, 17 gallons.

Total quantity of water pumped each year since the works commenced operations:

1873.....142,477,725 gallons.	1886.....779,761,852 gallons.
1874.....291,714,798 gallons.	1887.....827,195,009 gallons.
1875.....416,756,579 gallons.	1888.....872,990,164 gallons.
1876.....518,197,129 gallons.	1889.....944,472,747 gallons.
1877.....538,847,186 gallons.	1890.....988,771,453 gallons.
1878.....530,197,397 gallons.	1891.....1,014,475,024 gallons.
1879.....672,344,128 gallons.	1892.....962,953,662 gallons
1880.....827,067,372 gallons.	1893.....1,044,256,236 gallons.
1881.....944,382,043 gallons.	1894.....1,024,735,621 gallons.
1882.....775,642,466 gallons.	1895.....1,122,363,460 gallons.
1883.....773,942,702 gallons.	1896.....1,009,523,471 gallons.
1884.....831,867,463 gallons.	1897.....944,545,290 gallons.
1885.....836,970,016 gallons.	1898.....1,038,794,253 gallons.

WATER PUMPED—1898.

Month.	Gaskill Engines.			Quadruplex Engines.			Rotary Pumps-			Totals.		Fires.					
	Hours Run.	Revolutions.	Gallons Pumped.	Hours Run.	Revolutions.	Gallons Pumped.	Hours Run.	Revolutions.	Gallons Pumped.	Gallons Pumped.	Daily Average.	No. Alarms.	Hours Run.	Highest Pressure	Lowest Pressure	Average Pressure	Gallons Pumped.
January...	727:35	726,766	84,394,800	22	50,043	2,752,365	.....	.....	.....	87,147,165	2,811,199	8	4:46	70	70	70	802,250
February..	672	669,141	79,627,779		.....	.....	.....	.....	.....	79,627,779	2,843,849	4	2:30	70	70	70	443,037
March	738:30	708,731	78,481,452	5:30	15,409	847,495	.....	.....	.....	79,328,947	2,558,998	10	5:09	70	70	70	792,659
April.....	720	614,648	73,143,112	.	.....	.....	.....	.....	.....	73,143,112	2,438,104	14	13:14	80	70	76	2,441,404
May. .	737:40	660,542	78,604,498	6:20	16,191	890,505	.....	.....	.....	79,495,003	2,564,355	14	7:40	80	70	73	1,312,372
June. ...	712:50	706,288	84,048,272	7:10	18,518	1,018,490	2:15	9,880	167,110	85,233,872	2,841,129	12	8:52	70	70	70	1,680,161
July. ...	743:15	811,629	96,583,851	7:55	11,798	648,890	:40	2,082	35 394	97,268.135	3,137,682	19	13:18	80	60	74	2,718,986
August....	741:20	768,331	91,431 389	2:40	7,841	431.255	.....	.....	.....	91,862,644	2,963,311	16	6:19	70	70	70	1,057,077
September	717:40	797,652	94,920,588	3:55	10,421	573,155	.....	.....	.....	95,493,743	3,183,125	13	14:58	80	70	72	3,197,726
October....	738	794,015	94,487,785	6	13,993	769,615	4:15	17,417	296,089	95,553,489	3,082,371	9	7:03	80	70	75	1,387,183
November	713:55	735,401	87,512,719	6:05	17,758	976,690	.....	.....	.....	88,489,409	2,949,647	16	4:51	70	70	70	800,037
December.	736:43	714,450	85,019,550	7:17	20,571	1,131,405	.....	.....	.....	86,150,955	2,779,063	10	7:57	80	70	73	1,494,521
Totals...	8,699:23	8,707,594	1,028,255,795	74:52	182,543	10,039,865	7:10	29,379	498 593	1,038,794,253	2,846,012	145	96:35	80	60	72½	18,027,413

In January the right Gaskill engine and pump were run 20 5-60 hours, with the left engine and pump shut down, making 35,132 revolutions.

In March the right Gaskill engine and pump were run 53 40-60 hours, with the left engine and pump shut down, making 98,146 revolutions.

The greatest quantity of water pumped in one day was 4,101,218 gallons, September 4th.

The least quantity of water pumped in one day was 2,210 588 gallons, April 17th.

GENERAL MAINTENANCE AND REPAIRS.

The cost of maintenance and repairs, besides the expense of operating the pumping engines, was $5.472.72, as follows:

Salary of superintendent and secretary	$1,710 00	
Salary of office assistant	760 00	
Office expenses	513 47	
Repairs on main distribution	552 26	
Repairs and care of services	371 14	
Repairs and care of water meters	775 69	
Repairs and care of inlet works	585 71	
Service connections	102 67	
Repairs to engine house and grounds	102 78	
		$5,472 72

Office Expenses.

The office expenses were:

Heating and lighting (old office)	$ 50 45	
Moving office and shop to city hall	44 50	
Pipe to connect pressure-recording gauge	22 18	
Fitting up shop in city hall	73 99	
Fitting up office in city hall	39 40	
Rent of telephone, office and superintendent	34 10	
Blank books, stationery and printing	134 95	
Postage stamps and postal cards	108 45	
Gauge dials	4 45	
		$ 513 47

Repairs on Main Distribution.

The repairs on main distribution were:

Labor examining, testing and repairing hydrants	$ 159 74	
Parts of hydrants from manufacturers for repairs	35 00	
Labor repairing valves and valve boxes	14 47	
Labor repairing leaks in main pipes	221 39	
Pipe for repairing leaks	56 46	
Lowering pipe in Lincoln avenue for sewer	10 12	
Tools and repairing tools	32 73	
Drayage, street cars, etc	22 35	
		$ 552 26

The number of leaks in main pipes during the year was 63, of which 1 was a lead joint in cast iron pipe and 62 were in Wyckoff pipe. Of the 62 leaks in Wyckoff mains, 14 were burst pipes, 44 were leaks in joints, and 4 were knot holes.

One main was lowered to make way for a sewer.

All of the hydrants have been carefully tested and examined twice during the year, besides the continuous examination which is maintained during extreme cold weather to guard against frozen hydrants.

Twenty hydrants have been found broken in some of their parts, requiring repairs, and during the month of February, 3 hydrants were found frozen.

Repairs and Care of Services.

The amount expended on the repairs and care of services was $371.14, as follows:

Labor turning on and shutting off	$232 00	
Examining services	52 75	
Labor repairing private mains	31 62	
Pipe used in repairing private mains	15 39	
Labor in repairs to lead services	11 23	
Changing service connections	2 50	
Repairing valves on large services	9 15	
Drayage, street car fares, etc	16 50	
		$371 14

The whole number of services shut off by employees of this department during the year was 319, of which 42 were shut off for non-payment of rates; 130 were premises found vacant; 126 were shut at the request of the consumer, and 21 for leakage.

The number of services turned on by employees of this department was 336.

Ten private mains supplying several consumers each were found leaking, and repaired by employees of this department, and three lead services have been repaired by this department.

Repairs and Care of Water Meters.

The amount expended for the repair and care of water meters was $775.69, as follows:

Reading meters	$238 50	
Labor repairing meters	244 16	
Parts of meters from manufacturers for repairs	57 36	
Repairing meter boxes	53 04	
Cleaning and starting stuck meters	43 62	
Changing meters	15 30	
Tools and repairing tools	8 42	
Meter prover and connecting up same	95 14	
Drayage, street car fares, etc.	18 75	
Paint, acid, etc	1 40	
		$ 775 69

Seventy-four meters have been found broken or so worn as to require repairs. 61 of these meters have been repaired by the inspector, and one was sent to the factory for repairs. 65 meters not broken have been found not registering properly, taken out, cleaned, tested and replaced.

As the meters are the property of the city, and kept in repair without expense to the consumer, it requires constant care that the meters be properly set in the first place, and that they are not afterwards exposed to danger from frost. In several cases the meters have suffered injury from the carelessness of consumers or plumbers engaged in making repairs, by reason of the meter being uncovered and left exposed until discovered by employees of this department. In one or two cases the circumstances have been such as to warrant charging the cost of the repairs to the consumer, and this should be done in every case where it is evident that the injury is due to this cause.

Repairs and Care of Inlet Works.

The cost of taking care of the inlet works at the bay has been:

Salary of reservoir keeper	$420 00
Labor on repairs and cleaning out grass	113 10
Clearing ice from cut	6 87
Tools and repairing tools	7 70
Rent of telephone	7 11
Signs for banks	6 00
Cement, drayage, lumber, etc.	24 93
	$ 585 71

The action of the ice during the winter caused some disturbance of the brick facing of the inlet basin, and it becomes necessary each spring to go over it and cement those places where the brick has been disturbed. It is also necessary to remove the growth of grass from the inlet cut at least once in each season, which involves a large amount of labor.

In February last it became necessary to cut a channel through the ice several hundred feet in length to admit the water to the basin.

It is hoped that with the cleaning out of the inlet cut a portion of this trouble and expense will be avoided.

Service Connections.

The amount expended on account of service connections was:

Corporation stops bought	$ 27 62
Labor putting in service taps	23 50
Pipe for branch services	10 55
Labor on branch services	37 75
Rethreading old taps	3 25
	$ 102 67

The number of new service connections made with main pipes was 119, and 5 small services were joined to private mains.

Of the 119 connections made with main pipes, 116 were made with corporation stops and 3 were large connections made with branch castings.

Seventy-six corporation stops and 2 branches were placed in the new cast iron main pipes in Center avenue and on Water street, to replace old connections with the pipes abandoned on those streets, and the cost of making these connections and of connecting up the services therewith, was charged to the cost of these main pipes; 2 were put in to replace other old taps taken out, and 39 were for new services.

The number of service connections taken out or permanently abandoned (main discontinued) during the year was 110, of which 109 were corporation stops and one was a branch. Three corporation stops, heretofore reported abandoned, were taken out during the year.

Whole number of service connections in main pipes Dec. 31st, 1898, 2,034.

Whole number of separate services supplied, 2,116.

The service connections put in in 1898 were:

	Branches.			Corporations.				Total
	8 in.	6 in.	4 in.	1 in.	¾ in.	⅝ in.	½ in.	
In cast iron mains	....	1	1	1	33	39	16	91
In Wyckoff mains	1	....	....	....	3	8	16	28
Total	1	1	1	1	36	47	32	119

The service connections taken out or permanently abandoned (main discontinued) were:

	Branches.	Corporations.					Totals.
	6 in.	2 in.	1 in.	¾ in.	⅝ in.	½ in.	
In Wyckoff mains	1	1	24	44	10	33	113

The service connections in main pipes December 31st, 1898, are:

	Branches.					Corporations.							Total
	8 in	6 in	4 in	3 in	2 in	2 in.	1¼ in	1 in.	¾ in.	⅝ in	½ in	⅜ in	
Cast iron mains	1	5	11	3	4	2	4	59	101	111	146	5	452
Wyckoff mains..	2	2	14	1	2	1	.....	160	390	425	579	6	1,582
Total.....	3	7	25	4	6	3	4	219	491	536	725	11	2,034

The abandoned service connections not taken out are:

	Branches.		Corporations.					Total
	4 in.		1 in.	¾ in.	⅝ in.	½ in.	⅜ in.	
In cast iron mains.....	2	.....	9	10	5	12	4	42
In Wyckoff mains.....	1	.....	16	23	9	28	.....	77
Total	3	.....	25	33	14	40	4	119

The number of services open at the end of the year was 1,501, and the number closed was 615. Of the services closed, 137 are closed temporarily, there being no use of water during the winter season. 161 are closed for non-payment of rates, and not re-opened; 106 are closed on account of premises being vacant; 11 services found leaking and not repaired; 9 are services not completed; 88 have been closed at the request of consumer; 26 are supplied through other services; and 77 are to premises from which the buildings have been removed or burned and not rebuilt. This enumeration includes all the services connected with the works, except those connected with the 119 taps permanently abandoned, and shut at the main pipe, but which may be renewed. Some of the services closed have been shut off several years.

Accompanying this report is the usual summary of statistics, compiled in accordance with the recommendation of the New England Water Works Association.

All of which is respectfully submitted.

E. L. DUNBAR,

Bay City, Feb. 20, 1899. Superintendent and Secretary.

Summary of Statistics.

REPORT FOR 1898.

Water Works of Bay City, Michigan.
Built in 1872.
Owned by city.
Source of supply, Saginaw Bay, an arm of Lake Huron.
Mode of supply, direct pumping.

PUMPING.

1. Builders of pumping machinery, Holly Manfg. Co.
2. Coal used, bituminous slack.
3. Coal consumed for year, 3,646,995 pounds.
4. Wood consumed for year, $\frac{22,000}{3}$ 7,333 pounds.
5. Total fuel consumed, 3,654,328 pounds.
6. Total pumpage for year, 1,038,794,253 gallons.
8. Average dynamic head against which pumps work, 113 feet.
9. Number of gallons pumped per pound of coal, 284.
10. Duty $\frac{1,038,794,253 \times 8.34 \times 100 \times 113}{3,654,328}$ 26,789,924.

    Cost of pumping based on total pumping station expenses, $7,325.53.
11. Per million gallons pumped, $7.06.
12. Per million gallons raised 100 feet, 6.24.

    Cost of pumping based on total maintenance, including interest:
13. Per million gallons pumped, $35.85.
14. Per million gallons raised 100 feet, $31.73.

Financial—Maintenance.

RECEIPTS—DIVISION I.

	From consumers—		
A.	Water rates, domestic	$16,618 28	
B.	Water rates, manufacturing	5,381 33	
C.	Net receipts from water		$22,029 61
D.	Miscellaneous, service connections, etc		252 88
E.	Total receipts from maintenance		22,282 49
	From public funds—		
J.	Tax levy for interest		24 470 00
	K. Total		$16,752 49

DIVISION II.

	From fixed rates—		
L.	Domestic	$ 9,328 43	
M.	Manufacturing	727 03	
N.	Total fixed rates		$10,065 46
	From meter rates –		
O.	Domestic	$ 7,309 85	
P.	Manufacturing	4,654 30	
Q.	Total meter rates		$11,964 15

EXPENDITURES.

AA.	Management and repairs	$12,733 70	
BB.	Interest on bonds	24.470 00	
CC.	Total maintenance		$37,203 70
DD.	Balance to construction		9,548 79
	EE. Total		$16,752 49

Construction.

R.	Balance from former years	$12,219 78	
	Balance from maintenance	9,518 79	
U.	From main distribution	92 69	
	From water meters	2 00	
	From furniture and fixtures	3 00	
			$21,856 26
W.	Net cost of works to date		$579,947 60

FF.	Extension of mains	$ 7,997 93	
HH.	Water meters	998 90	
I I.	Total construction		$ 8 996 83
J J.	Balance		12,859 43
			$21,856 26
X.	Bonded debt		$462 000

CONSUMPTION.

1. Estimated population at date, 33,000.
2. Estimated population on pipe lines, 21,000.
3. Estimated population supplied, 16,000.
4. Total gallons supplied, 1,038,794,253.
5. Passed through domestic meters, 53,936,761 gallons. 5.19 per cent.
6. Passed through manufacturing meters, 54,703,543 gallons, 5.26 per cent.
7. Average daily consumption, 2,846,012 gallons.
8. Gallons per day to each inhabitant, 86.
9. Gallons per day to each consumer, 177.
10. Gallons per day to each service (distribution 22), 1,486.

DISTRIBUTION—MAINS.

1. Material, cast iron and Wyckoff patent.
2. Size, 3 inch to 20 inch.
3. Extended, 11,500 feet,
4. Discontinued, 11,291 feet.
5. Total in use, 44 miles.
6. Cost of repairs per mile, $12.55.
7. Leaks per mile, 1 43-100.
8. Small distribution less than 4 inches, 319 feet.
9. Hydrants added, 1.
10. Number in use, 404.
11. Stop gates added, 9.
12. Number in use, 687.
13. Number of small gates less than 4 inches, 3.
14. Number of blow-off gates, 16.
15. Ranges of pressure (domestic) at center day and night, 35 to 38 pounds.

SERVICES.

16. Material, lead, wrought iron, cast iron and Wyckoff.
17. Sizes, ⅝ inch to 8 inch.
21. Service taps added, 18.
22. Number in use, 1,915.
25. Meters added, 45.
26. Number in use, 726.

Uses Supplied at Fixed Rates January 1st, 1899.

Automatic Sprinklers	3	Hose for Sprinkling	219
Bakeries	3	Laboratory	1
Barber Shops	6	Laundries	2
Bath Room (public)	1	Mattress Factory	1
Bath Room (Turkish)	1	Meat Warehouses	2
Baths (private)	140	Offices	24
Bicycle Repair Shop	1	Passenger Depot	1
Billiard Rooms	1	Paint Shop	1
Blacksmith Shops	3	Pawn Shop	2
Boilers (power)	4	Photograph Galleries	3
Boarding Houses	3	Plumbing Shops	2
Bottling Works	6	Printing Offices	3
Bowling Alleys	2	Restaurants	5
Business Blocks	10	Saloons	35
Butcher Shops	8	Schools	15
Carriage Shops	3	Shoe Shop	1
Canning Works	1	Skating Rink	3
Chicory Factory	1	Stable (hotel)	1
Churches	4	Stables (livery)	5
Cigar Factories	2	Stables (mill)	2
Clothes Cleaning	2	Stables (private)	74
Curling Rink	1	Stone Yard	1
Dwellings	555	Stores	69
Express Office	1	Tailor Shops	1
Fire Pipes	2	Telegraph Office	1
Gas Works	1	Telephone Exchange	1
Gas Engines	2	Tin Shop	1
Green Houses	2	Undertaker's Rooms	1
Halls (public)	5	Water Closets and Urinals	336
Harness Shop	1	Water Motor Pumps	4
Hotels	11	Warehouses	1

Uses Supplied Through Meters January 1st, 1899.

Armory	1	Green Houses	4
Ashery	1	Halls (public)	11
Automatic Sprinkler	2	Hotels	10
Bakeries	4	Hose for Sprinkling	419
Banks	4	Kindling Factory	1
Barber Shops	2	Laundries	4
Bath Rooms (public)	1	Locomotive Round House and Tank	1
Baths (private)	395	Locomotive Stand Pipe	1
Bicycle Factory	1	Machine Shop	6
Blacksmith Shop	1	Masonic Temple	1
Boarding Houses	6	Offices	33
Boilers (power)	46	Opera House	1
Boiler Shops	2	Passenger Depots	2
Bottling Works	4	Photograph Gallery	1
Box Factories	5	Pipe Factory	1
Brewery	1	Planing Mills	13
Business Blocks	25	Plow Factory	1
Business College	1	Plumber's Shop	1
Butcher Shops	6	Printing Offices	5
Carpenter Shop	1	Railroad Coach Yard	1
Carpet Cleaning	1	Restaurant	2
Canning Works	1	Saloons	10
Cemetery	1	Salt Blocks	6
Chemical Works	1	Saw Mills	8
Churches	6	Sash and Door Factories	2
Club Rooms	3	Schools	1
Coal and Wood Yards	2	Stables (hotel)	2
County Court House	1	Stables (livery)	7
County Jail	1	Stables (mill)	5
Cracker Factory	1	Stables (omnibus)	1
Cross Arm Factory	1	Stables (private	88
Crystal Water Works	1	Stables (street car)	1
Drainage Pump	1	Stave and Heading Factory	2
Drill Houses	3	Stores	62
Dwellings	500	Telegraph Office	1
Electric Light Works	1	Telephone	1
Elevator Tanks	5	Tin Shop	1
Fire Pipes	17	Undertaker's Room	1
Flouring Mills	3	Water Closets and Urinals	996
Foundries	5	Water Motor Pumps	70
Freight Depot	1	Warehouses	1
Gas Engines	3	Woodenware Works	1
Government Building	1		

City Uses for Which no Payment is Made.

1 City Hall.
6 Steamer, Truck and Hose Houses, 20 Horses, 2 Steamers, and 1 Chemical.
1 Electric Light Station, 3 boilers.
30 Water Closets and Urinals in city buildings.
6 Baths in city buildings.
12 Public Watering Troughs.
4 Ornamental Fountains.
10 Lawn Hose, for sprinkling parks.
2 Street Sprinkler Carts.
404 Public Fire Hydrants.

Uses Shut Off January 1st, 1899.

Baths (private)	27	Hose for Sprinkling	170
Barber Shops	4	Hotels	15
Basement	1	Market Garden	1
Blacksmith Shops	8	Machine Shops	2
Boarding Houses	6	Mortar Yards	2
Boilers (power)	2	Offices	3
Boiler Shops	2	Pasture Lots	2
Broom Factory	1	Photograph Galleries	2
Business Blocks	7	Planing Mills	2
Butcher Shop	1	Plumber Shop	1
Carpet Cleaning	1	Round Hoop Factory	1
Cemeteries	4	Saloons	13
Churches	2	Salt Block	1
Drill Houses	2	Shingle Mill	1
Dry Kilns	1	Shoe Shop	1
Dwellings	260	Saw Mills	1
Excelsior Works	1	Stables (mill)	2
Fair Grounds	1	Stables (private)	24
Fire Pipes	5	Stores	64
Fish Market	1	Undertaker's Room	1
Fountains	1	Vacant Lots	65
Hall (public)	1	Warehouses	2
Harness Shops	2	Water Closets and Urinals	104

TWENTY-EIGHTH ANNUAL REPORT

—OF—

WATER DEPARTMENT



Bay City, Michigan



December 31st

1899

Twenty-Eighth

ANNUAL REPORT

—OF THE—

WATER DEPARTMENT

—OF—

BAY CITY, MICHIGAN.

December 31st, 1899.

BAY CITY, MICH.:
C. & J. GREGORY CO., PRINTERS
1900.

Water Department.

1900.

COMMISSIONERS.

G. HENRY SHEARER, PRESIDENT.
(Term Expires Sept. 6th, 1902.)

FREMONT J. TROMBLE.
(Term Expires Sept. 6th, 1900.)

ARTHUR F. BROOKMAN.
(Term Expires Sept. 6th, 1901.)

BENJAMIN F. RAY.
(Term Expires Sept. 6th, 1903.)

ROBERT E. BOUSFIELD.
(Term Expires Sept. 6th, 1904.)

HOMER E. BUCK.
(Term Expires Sept. 6th, 1905.)

WALTER S. COUSINS.
(Term Expires Sept. 6th, 1906.)

DEPARTMENT OFFICERS AND EMPLOYEES.

E. L. DUNBAR.....Supt. and Secy.
T. A. DELZELL.....Office Assistant.
FRANK H. COLLINS.....Inspector.
THOMAS LARDNER.....Turnkey.
L. D. CARPENTER.....Reservoir Keeper.
A. B. VERITY.....First Engineer.
JAS. E. DARLING.....Second Engineer.
JAS. H. MCGIBBONS.....Fireman
FRANK O'HARE.....Fireman.

Superintendent's Report.

To the Honorable the Board of Water Commissioners of Bay City, Michigan:

GENTLEMEN: The report of the operations of the Water Department of this city for the year ending December 31st, 1899, is herewith respectfully submitted.

During the year the Board has been called upon to mourn the loss by death of one of its old and honored members. On the 18th day of July, Hon. Andrew Walton passed away after a protracted illness. Mr. Walton had been a member of this Board about 27 years, and for 13 years of that period he was President of the Board.

The term of office of Mr. Sanford V. Wilkin expired on the 6th day of September, 1897; that of Mr. Louis Moritz on the 6th day of September, 1898; and that of Mr. Duncan McGregor on the 6th day of September, 1899. At a session of the Common Council, held October 16th, 1899, all the vacancies on the Board were filled by the appointment of Arthur F. Brookman to fill the unexpired term of Mr. Walton, Robert E. Bousfield to take the place of Mr. Wilkin, Homer E. Buck to take the place of Mr. Moritz, and Walter S. Cousins to take the place of Mr. McGregor. On the 31st day of October the Board met and organized by the appointment of Commissioner G. Henry Shearer as President, and E. L. Dunbar as Secretary of the Board for the ensuing year.

The quantity of water pumped during the year was 1,118,599,631 gallons, an increase of 79,805,378 gallons over the year 1898. Nearly 75,000,000 gallons were supplied to the North American Chemical Company, which is about 50,000,000 gallons more than was furnished them in 1898; 188,841,968 gallons were delivered through meters, an increase over the preceding year of 80,201,618 gallons.

Assuming that 250,000,000 gallons are used annually for necessary public uses, embracing the supply to twelve drinking fountains, four ornamental fountains, the city hall, six hose houses, flushing sewers and the water used for extinguishing fires, there remains about 775,000,000 gallons as having been supplied through the 1,300 unmetered services, and wasted. With a liberal estimate for the quantity of water required to supply the unmetered services, there is still fully 500,000,000 gallons that can only be accounted for as unnecessarily wasted.

From early in October until the close of the year from 500,000 to 1,500,000 gallons were drawn daily from the intake pipe by the two sugar factories located in Essexville. These factories were granted permission to connect with the intake pipe upon condition that if at any time the use of the water therefrom by said sugar factories impaired the supply to the city, such use should be discontinued. It was also distinctly agreed that only such water should be taken from said intake pipe as was necessarily used in direct contact with the pulp after the beets were washed and sliced.

A careful examination of the plant of the Michigan Sugar Company during the first season of their operations, the winter of 1898-9, showed an unnecessary waste of water at their plant, and such changes in the piping of the plant as were requested by your Superintendent were made during the past summer, while the plant was not in operation. As a result of these changes there has been no unnecessary waste of the water taken from the intake pipe during the present operating season by that company.

The experience with the Michigan Company caused the Board to believe that with proper care in the use of the water, the Bay City Sugar Company could also be supplied from the intake pipe for those uses to which the river water could not be applied, without interrupting the supply.

It was found, after the Bay City Sugar Company had commenced operations, that certain appliances for regulating the draught of water from the intake pipe, which were to be used. had been ignored, and as a result, the supply to the city has been seriously interrupted. If this abuse of privilege is not corrected before the commencement of another season's operations, their connection with the intake should be removed.

The large consumption of water in the city, and the amount drawn from the intake pipe by the sugar factories, have rendered it necessary to use the river intake to a much larger extent than ever before. Besides the time that the sugar factories were in operation, the river intake was in use to nearly double the extent that it was used in 1898, and unless the consumption of water in the city can be materially reduced, the time has arrived when a larger intake from the bay is necessary. As a new intake, when constructed, should be not less than five feet in diameter, and as such an inlet will involve an expenditure of about $300,000, it will be necessary to submit the matter to a vote of the electors of the city, before the work can be done. My recommendation is, that the question of issuing the bonds of the city for an amount sufficient to cover the cost of a new intake be submitted to the people, either at a special election to be held some time during the early summer, or at the general election to be held next November, and that the Board at once commence a careful investigation of the subject with a view to determining the best location for such intake and the most economical method of construction. Should this recommendation not meet the approval of your honorable Board or of the honorable Common Council, or should the issue of bonds for this purpose be negatived by the electors of the city, I would advise a material exten-

sion of the meter system, and the employment of such additional inspectors as may be necessary to secure a more frequent and thorough inspection of unmetered services.

About one and one third miles of the old mains laid when the works were built have been replaced during the year with cast iron. There remains about nine miles of these old mains to be replaced as rapidly as possible. The paving of First and Third streets on concrete foundation, which has been determined upon for the coming season, will make it necessary to renew these old mains at every point where they cross these streets. It will be necessary to renew the pipe in Second street from the alley between Jefferson street and Madison avenue to the alley between Jackson and Van Buren streets, a portion of which has been already abandoned. The pipe in Tenth street from the alley between Jefferson street and Madison avenue to Grant street should also be renewed.

If the intake from the bay is to remain in its present location, the work of cleaning the inlet cut should be completed, and the protection on the north side of the north bank of the inlet basin will require renewal for at least a portion of its length. The residence of the reservoir keeper at the bay also requires some repairs.



FINANCIAL.

Receipts.

The receipts of the department for the year have been $23,055.65, as follows:

From water rates, roll of 1895	$ 19 30	
From water rates, roll of 1896	15 65	
From water rates, roll of 1897	84 50	
From water rates, roll of 1898	758 49	
From water rates, roll of 1899	21,626 03	
Total from water rates		$22,503 97
From plumbers' license	$ 35 00	
From service connection	217 60	
From furniture and fixtures	100 00	
From repairs on main distribution	14 27	
From cast iron pipe account	140 96	
From valve account	13 50	
From fire hydrant account	20 00	
From laying pipe account	10 35	
Total from miscellaneous sources		551 68
Total receipts		$23,055 65

Receipts by months:

January	$ 958 39	
February	507 65	
March	1,242 04	
April	1,560 99	
May	861 27	
June	1 736 06	
July	1,847 64	
August	747 06	
September	2,046 06	
October	2,128 45	
November	1,179 32	
December	8,240 72	
		$23,055 65

Expenditures.

The expenditures of the department for the year have been $24,017.20, as follows:

FOR MAINTENANCE AND OPERATING EXPENSES.

Office department:

Superintendent and secretary's salary	$1,800 00
Office assistant's salary	800 00
Office expenses	271 55

Street and service department:

Repairs on main distribution	891 92
Repairs and care of services	374 59
Repairs and care of water meters	781 84
Repairs and care of inlet works	2,759 04
Service connections	92 22

Pumping department:

Salaries of engineers and firemen	3,620 00
Fuel	2,791 88
Oil, packing and engineers' supplies	281 14
Repairs on engines and boilers	923 87
Repairs on boiler arches	204 90
Repairs to engine house and grounds	294 02
Total maintenance and operating expenses	$15,986 97

FOR CONSTRUCTION.

Water meters	$286 30
Setting meters	56 44

Main distribution:

Cast iron pipe	4,474 01
Valves	209 18
Fire hydrants	220 00
Laying pipes	2,884 30
Total for construction	$8,030 23
Total expenditures	$24,017 20

Ledger Balances—Bay City Water Works,

FOR THE YEAR 1899.

Ledger F.		Dr.	Cr.
Folio	50. Water Rates, roll of 1895	.....	$19 30
"	50. Water Rates, roll of 1896	.....	15 65
"	49. Water Rates, roll of 1897	.....	84 50
"	48. Water Rates, roll of 1898	.....	758 49
"	47. Water Rates, roll of 1899	.....	21,626 03
"	51. Plumbers' licenses	.....	35 00
"	51. Furniture and fixtures	.....	100 00
"	59. Service connections	.....	94 78
"	52. City water works fund	.....	961 55
"	53. Office department salaries	$2,600 00	
"	54. Office department expenses	271 55	
"	66. Street and service dept., repairs on main distribution.	877 65	
"	56. Street and service dept., repairs and care of services..	374 59	
"	74. Street and service dept, rep's and care of water meters	781 84	
"	58. Street and service dept, rep's and care of inlet works.	2,759 04	
"	60. Pumping department, salaries	3,620 00	
"	61. Pumping department, fuel	2,791 88	
"	62. Pumping department, oil, packing and supplies	281 14	
"	63. Pumping department, repairs on engines and boilers..	923 87	
"	64. Pumping department, repairs on boiler arches	204 90	
"	65. Repairs to engine house and grounds	294 02	
"	67. Water meter account, water meters	286 30	
"	68. Water meter account, setting meters	56 44	
"	69. Main distribution, cast iron pipe	4,321 20	
"	70. Main distribution, valves	179 93	
"	71. Main distribution, fire hydrants	260 00	
"	73. Main distribution, laying pipe	2,870 95	
		$23,695 30	$23,695 30

Ledger Balances—December 31st, 1899.

Ledger F.		Dr.	Cr.
Folio	1. Bay City bond account ($452,000)	.....	$443,045 87
"	1. Water assessment (frontage on pipe)	.....	736 07
"	28. Service connection and service boxes	.....	3,655 62
"	29. Plumbers' licenses	.....	930 20
"	30. Rents, dockage, etc	.....	2,627 33
"	32. Water rates	.....	476,543 53
"	2. Construction—real estate	$6,724 83	
"	2. " dock tramway and store shed	1,882 63	
"	3. " engine house, chimney and wells	21,401 42	
"	3. " engine foundation and boiler foundation and arches	6,777 45	
"	4. " pumping machinery	59,427 72	
"	4. " inlet from Saginaw river	4,799 46	
"	5. " inlet from Saginaw bay	84,778 37	
"	5. " reservoir, breakwater, etc., at bay	24,713 78	
"	6. " cast iron pipe and branches	118,116 20	

Folio	6.	Construction—	Wyckoff patent pipe	126,441 31	
"	7.	"	valves for street mains	16,763 74	
"	7.	"	public fire hydrants	15,587 27	
"	8.	"	laying pipe	66,444 08	
"	8.	"	buildings at bay	452 46	
"	9.	"	water meters	18,474 56	
"	9.	"	furniture and fixtures	887 96	
"	10.	"	implements	1,713 61	
"	10.	"	engineering and gen'l superintendence	7,856 17	
"	11.	"	traveling expenses	306 29	
"	11.	"	insurance	29 00	
"	12.	"	interest, discount and commissions	4,224 17	
"	15.	Maintenance—	office expenses and salaries	65,910 77	
"	16.	"	repairs and care of hydrants, valves and pipes	20,706 20	
"	17.	"	repairs and care of water meters	6,917 98	
"	18.	"	repairs and care of inlet works and pipe	37,425 92	
"	19.	"	repairs to engine house and grounds	3,837 22	
"	20.	"	repairs to dock	13 38	
"	20.	"	interest (on bills payable)	3,709 84	
"	21.	"	implement account	1,129 37	
"	22.	"	engineers' and firemen's wages	95,310 90	
"	23.	"	fuel account	72,269 77	
"	24.	"	oil, packing and engineers' supplies	9,970 84	
"	25.	"	repairs to pumping machinery	8,858 10	
"	26.	"	repairs to boiler arches	1,726 51	
"	27.	"	repairs to engine foundations	51 46	
"	34.	"	city water works fund	11,897 88	
				$927,538 62	$927,538 62

Account with Water Works Fund.

	Dr.	Cr.
Balance in water works fund January 1st, 1899	$12,859 43	
Cash collections deposited with city treasurer	23,055 65	
By Recorder's warrants Nos. 359 to 370, inclusive	.....	$24,017 20
Balance in water works fund December 31st, 1899	.....	11,897 88
	$35,915 08	$35,915 08

Account with City Treasurer as Treasurer of Board.

To Recorder's warrants No. 359 to 370, inclusive	$24,017 20	
By paid orders of secretary of board Nos. 4761 to 5229	.....	$24,017 20
	$24,017 20	$24,017 20

Bonds and Interest.

The city has paid and retired during the year $10,000 of the original issue of bonds. The bonds paid were issued August 15th, 1872, and payable February 16th, 1899. These bonds

were paid with money raised by tax levy, as also was the annual interest on outstanding bonds amounting to $23,190.00. The total amount of interest paid to date on water work bonds is $758,755.00. $100,000 of the principal of said bonds has been paid and retired, leaving amount of water works bonds outstanding $352,000.00; $199,000.00 bearing interest at the rate of 8 per cent per annum, $75,000.00 at the rate of 5 per cent per annum, $78,000.00 at the rate of 4 per cent per annum.

Bonds Outstanding December 31st, 1899.

Series.	Date of Issue.	Date Payable.	Amount.	Interest.
No. 14	Aug 15, 1872	Feb. 16, 1900	$10,000 00	8 per cent.
No. 15	" 15, 1872	" 16, 1901	10,000 00	8 "
No. 16	" 15, 1872	" 16, 1902	10,000 00	8 "
No. 17	" 15, 1872	" 16, 1903	10,000 00	8 "
No. 18	" 15, 1872	" 16, 1904	9,000 00	8 "
No. 19	" 15, 1873	" 16, 1905	10,000 00	8 "
No. 20	" 15, 1873	" 16, 1906	10,000 00	8 "
No. 21	" 15, 1873	" 16, 1907	10,000 00	8 "
No. 22	" 15, 1873	" 16, 1908	10,000 00	8 "
No. 23	" 15, 1873	" 16, 1909	10,000 00	8 "
No. 24	Feb. 15, 1874	" 16, 1910	10,000 00	8 "
No. 25	Apr. 15, 1874	Apr. 15, 1911	10,000 00	8 "
No 26	" 15, 1874	" 15, 1912	10,000 00	8 "
No. 27	" 15, 1874	" 15, 1913	20,000 00	8 "
No. 33	Mar. 1, 1875	Mar. 1, 1900	10,000 00	8 "
No. 34	" 1, 1875	" 1, 1901	10,000 00	8 "
No. 35	June 1, 1875	June 1, 1902	10,000 00	8 "
No. 36	" 1, 1875	" 1, 1903	10,000 00	8 "
No. 37	" 1, 1875	" 1, 1904	10,000 00	8 "
Not seried—				
No. 1 to 25	May 1, 1891	May 1, 1905	25,000 00	5 "
No. 26 to 50	" 1, 1891	" 1, 1911	25,000 00	5 "
No. 51 to 63	" 1, 1891	" 1, 1917	12,500 00	5 "
No. 64 to 76	" 1, 1891	" 1, 1918	12,500 00	5 "
Refunding—				
No. 1 to 20	Oct 1, 1895	Oct. 1, 1920	20,000 00	4 "
No. 1 to 20	" 1, 1896	" 1, 1921	20,000 00	4 "
No. 1 to 20	" 15, 1897	" 15, 1927	20,000 00	4 "
No. 1 to 18	" 15, 1898	" 15, 1928	18,000 00	4 "
			$352,000 00	

Water Rates.

The total amount charged on roll of 1899 was:

For water supplied at fixed rates	$ 9,866 81	
For water supplied through meters	13,637 43	
		$23,504 24

The amount collected on roll of 1899 was:

From fixed rates	$ 9,230 64	
From metered water	12,395 39	
		$21,626 03

The amounts uncollected on roll of 1899 were:

From fixed rates	$ 636 17	
From metered water	1,242 04	
		$ 1,878 21

The amounts collected during the year from previous years' rolls were:

From fixed rates	$ 327 42	
From metered water	550 52	
		$ 877 94

The total amount collected on all rolls during the year was:

From fixed rates, domestic	$ 8,941 63	
From fixed rates, manufacturing	616 43	
From metered water, domestic	7,815 81	
From metered water, manufacturing	5,110 10	
		$22,484 07

The total amount collected and uncollected on each year's roll has been as follows:

YEAR.	COLLECTED.	UNCOLLECTED.	TOTAL ON ROLL.
1873, January 1st to April 30th	$ 728 83	$	$ 728 83
1873-4, May 1st, 1873, to April 30th 1874	5,440 80	1 60	5,442 40
1874-5, May 1st, 1874, to April 30th, 1875	6,908 16	44 85	6,953 01
1875, May 1st to December 31st	7,269 55	28 46	7,298 01
1876	9,571 26	82 73	9,653 99
1877	9,604 26	134 19	9,738 45
1878	10,078 15	394 71	10,472 86
1879	11 708 97	136 07	11,845 04
1880	13,155 74	120 25	13,275 99
1881	15,002 61	212 40	15,215 01
1882	17,352 47	158 85	17,511 32
1883	18,713 46	98 64	18,812 10
1884	18,892 02	129 89	19,021 91
1885	19,716 73	269 58	19,986 31
1886	19,356 61	118 74	19,475 35
1887	19,436 25	87 00	19,523 25
1888	21,278 62	120 80	21,399 42
1889	22,120 47	113 03	22,233 50
1890	23,297 81	202 81	23,500 62
1891	24,619 51	286 35	24,905 86
1892	24,185 81	280 32	24,466 13
1893	23,658 69	501 44	24,160 13
1894	22,836 60	530 66	23,367 26
1895	22,933 26	297 59	23,230 85
1896	23,113 76	328 37	23,442 13
1897	21,971 06	392 13	22,363 19
1898	21,966 05	805 64	22,771 69
1899	21,626 03	1,878 21	23,504 24
Totals	$476,543 53	$7,685 31	$484,228 84

Source of Supply.

The entire supply of the city has been drawn from the bay, 336 days, 22 hours and 34 minutes, and the intake from the river has been called upon to help out the supply 28 days, 1 hour and 26 minutes; 3 days and 22 hours of this time the entire supply was taken from the river while repairs were being made on the intake pipe; the balance of the time the river intake was open, only a small portion of the supply was taken from the river; 28 hours and 56 minutes were to supply extraordinary demands upon the works for extinguishing fires; 14 hours were to supply extraordinary demands on account of breaks in the distribution system in the city; 51 hours on account of extremely low water in the bay; 11 hours and 30 minutes for the purpose of making repairs on the inlet works at the bay, and on the intake pipe; 474 hours on account of the draught from the intake pipe by the sugar factories.

A careful estimate of the quantity of water admitted from the river, based upon the capacity of delivery of that intake at the several points of opening of the valve governing the supply from that source, places it at 31,500,000 gallons for the year, or a little less than 3 per cent of the entire supply.

The dates on which the river intake was open, the time it was open, were as follows:

January 1 and 2, 2 hours, 20 minutes, account of fire.
January 10, 18 minutes, account of fire.
January 11, 10 hours, account of break.
January 23, 45 minutes, account of fire.
January 26, 8 hours, account of sugar factory.
January 26, 18 minutes, account of fire.
January 27, 8 hours, account of sugar factory.
January 27, 10 minutes, account of fire.
January 28, 7 hours, account of sugar factory.
January 29, 50 minutes, account of fire.
January 31, 16 hours, account of sugar factory.
February 1, 18 " " " " "
February 2, 24 " " " " "

February	3,	24	hours, account of sugar factory.
February	4,	24	" " " " "
February	5,	12	" " " " "
February	6,	4	" " " " "
February	8,	24	" " " " "
February	9,	12	" " " " "
February	11,	24	" " " " "
February	12,	24	" " " " "
February	13,	24	" " " " "
February	14,	10	" " " " "
February	14,	50	minutes, account of fire.
February	16,	1	hour, account of fire.
February	19,	15	minutes, account of fire.
March	1,	2	hours, account of break.
March	18,	3	" " " low water.
March	31,	10	minutes, account of fire.
April	2,	2	hours, account of fire.
April	3,	1	" " " "
April	4,	15	minutes, account of fire.
April	17,	8	hours, account of low water.
April	18,	6	" " " " "
April	19,	11	" " " repairs.
April	20,	11	" " " "
April	24,	24	" " " "
April	25,	24	" " " "
April	26,	24	" " " "
May	5,	1	hour 30 minutes, account of fire.
July	4,	20	minutes, account of fire.
August	19,	10	hours, 30 minutes, account of repairs.
August	24,	2	" account of fire.
August	26,	8	" " " low water.
August	28,	6	" " " " "
August	29,	6	" " " " "
August	30,	7	" " " " "
August	31,	7	" " " " "
September	4,	20	minutes, account of fire.
September	15,	1	hour, account of repairs.
October	16,	5	" " " sugar factory.
October	20,	10	" " " " "
October	21,	2	" " " " "
October	24,	6	" " " fire.
November	1,	1	" " " "
November	2,	2	" " " sugar factory.
November	6,	1	" 30 minutes, account of sugar factory.

November 7, 4 hours, account of sugar factory.
November 8, 2 " " " " "
November 8, 2 " " " break.
November 11, 1 " " " sugar factory.
November 12, 3 " " " " "
November 12, 45 minutes, account of fire.
November 17, 5 hours, account of sugar factory.
November 26, 3 " " " " "
December 5, 2 " " " " "
December 6, 5 " " " " "
December 7, 9 " " " " "
December 8, 4 " " " " "
December 12, 12 " " " " "
December 15, 5 " " " " "
December 20, 3 " 30 minutes, account of sugar factory.
December 20, 3 " 30 " " " fire.
December 21, 3 " account of fire.
December 24, 20 minutes, account of fire.
December 25, 12 hours, account of sugar factory.
December 27, 24 " " " " "
December 28, 24 " " " " "
December 29, 24 " " " " "
December 30, 24 " " " " "
December 31, 24 " " " " "
Total 673 hours, 26 minutes.

PUMPING STATION.

One of the boilers (No. 2) purchased from the Holly Manufacturing Company in 1872, when the pumping plant was erected, has been replaced by a new steel boiler of the same dimensions, 16 feet in length and 66 inches in diameter.

The cost of the new boiler, including tearing down and rebuilding arch, and such feed pipe and blow-off pipes as were found necessary, was $858.96. The iron smoke flue from No. 4 and 5 boilers to the brick stack has been renewed at a cost of $77.00.

The total amount expended during the year for maintenance and operation of the pumping plant, including the renewals above mentioned, was $7,821.79, as follows:

For salaries of engineers and firemen	$3,620 00
For fuel	2,791 88
For oil, packing and engineers' supplies	281 14
For repairs on engines and boilers	923 87
For repairs on boiler arches	204 90
	$7,821 79

The salaries paid are:

First engineer, salary	$1,400 00
Second engineer, salary	900 00
Two firemen, each $360 00	1,320 00
	$3,620 00

The fuel used was principally coarse slack from the mines in this county.

The total quantity of coal purchased was 4,074,620 lbs. as follows:

1,898,400 lbs, Bay Coal Mining Company slack @ $1.25 per ton	$1,186 56
1,152,500 lbs. Michigan Coal Mining Company slack @ $1.15 per ton	662 65
195,100 lbs. Michigan Coal Mining Company slack @ $1.25 per ton.	121 94
420,500 lbs. Wenona Coal Mining Company slack @ $1.25 per ton	262 81
86,100 lbs. St. Charles slack @ $1.40 per ton	60 27
36,000 lbs. St. Charles slack @ $1.50 per ton	27 00
154,800 lbs. Michigan Coal Mining Company lump @ $1.65 per ton	127 73
25,600 lbs. Michigan Coal Mining Company lump @ $1.75 per ton	22 40
42,300 lbs. St. Charles lump @ $2.00 per ton	42 30
11,320 lbs. St. Charles lump @ $2.25 per ton	12 74
52,000 lbs. Massillon lump @ $2.40 per ton	62 40
4,074,620 lbs.	$2,588 79
Total slack coal, 3,788,600 lbs.	$2,321 23
Total lump coal, 285,020 lbs.	267 56
Unloading 4,063,300 lbs. from cars @ 10c per ton	203 00
	$2,791 88
Average price per ton delivered in bins	$1 37

The quantity of fuel on hand at the commencement of the year was:

25 cords of wood, cost	$12 50
30,115 lbs. of slack coal, cost	20 33
10,800 lbs. of lump coal, cost	10 96
	$43 79

The quantity of fuel on hand at the close of the year was:

14 cords of wood, cost	$ 7 00
75,000 lbs. Wenona Coal & Mining Company slack, cost	50 62
	$57 62

The quantity of fuel consumed during the year was:

11 cords of wood costing	$ 5 50
3,743,715 lbs. of slack coal	2,480 37
296,820 lbs. of lump coal	292 18
	$2,778 05
Total coal burned	4,040,535 lbs.
Total wood burned	22,000 lbs.
Wood reduced to coal $\frac{22000}{3}$	7,333 lbs.
Total coal equivalent	4,047,868 lbs.
The cost of oil, packing and supplies delivered at the pumping station during the year was	$ 281 14
Oil, packing and supplies on hand at the commencement of the year	61 14
Oil, packing and supplies on hand at the close of the year.	174 68
Oil, packing and supplies consumed	167 60

The net cost of maintaining and operating the pumping engines was $7,694.42, as follows:

For salaries of engineers and firemen	$3,620 00
For fuel consumed	2,778 05
For oil, packing and supplies used	167 60
For repairs to engines, boilers and arches	1,128 77
	$7,694 42

The total quantity of water pumped during the year was 1,118,599,631 gallons, of which 1,102,000,690 gallons were pumped against an average domestic pressure of 40 lbs. per square inch, and 16,598,941 gallons were pumped against an average fire pressure of 71¼ lbs. per square inch. The average lift of all water pumped from the surface of water in wells was 113 feet.

The right Gaskill engine and pump were run 8,690$\frac{18}{60}$ hours, and the left Gaskill engine and pump 8,627$\frac{35}{60}$ hours; quantity of water pumped by Gaskill engines and pumps, 1,112,281,754 gallons.

The quadruplex engines and pumps were run 54$\frac{35}{60}$ hours, pumping 4,954,290 gallons. The high pressure engine and rotary pumps were run 18$\frac{30}{60}$ hours, pumping 1,363,587 gallons.

There were 176 alarms for fire received at the pumping station and the pumping engines were run under fire pressure 88$\frac{12}{100}$ hours.

The cost of pumping based on net cost of maintaining and operating pumping engines, $7,694.42, was:

Per million gallons pumped	$6 88
Per million gallons raised 100 feet	6 09

The cost of fuel was:

Per million gallons pumped	$2 48
Per million gallons raised 100 feet	2 20

Pumping Plant.

BOILERS.

Five in number, all horizontal tubular boilers set in separate brick arches. Three boilers are 16 feet long, 66 inches diameter. One containing 105 tubes 16 feet long and 2¾ inches interior diameter, each of the other two containing 64 tubes 16 feet long and 3¾ inches interior diameter. Two boilers are 16 feet long, 60 inches diameter, each containing 48 tubes 16 feet long and 3¾ inches interior diameter.

The area of grate surface under each boiler is: No. 1, 27½ square feet; Nos. 2 and 3, each 24¾ square feet; Nos. 4 and 5, each 22½ square feet. Heating surface: No. 1 (½ shell $138\frac{34}{100}$ square feet, entire tubes $1,209\frac{51}{100}$ square feet) $1,347\frac{85}{100}$ square feet. Nos. 2 and 3 each (½ shell $138\frac{34}{100}$ square feet, entire tubes $1,005\frac{21}{100}$ square feet) $1,143\frac{55}{100}$ square feet. Nos. 4 and 5 each (½ shell $125\frac{66}{100}$ square feet, entire tubes $753\frac{98}{100}$ square feet) $879\frac{64}{100}$ square feet.

ENGINES AND PUMPS.

One Gaskill horizontal compound, condensing crank and fly wheel pumping engine; maximum capacity, 5,000,000 gallons in 24 hours.

One Holly quadruplex compound condensing crank and fly wheel pumping engine; maximum capacity, 3,000,000 gallons in 24 hours.

One horizontal high pressure piston engine, driving through gear two No. 10 Holly rotary pumps; maximum capacity, 2,500,000 gallons in 24 hours.

Capacity of Gaskill pumps per revolution, 119 gallons.

Capacity of quadruplex pumps per revolution, 55 gallons.

Capacity of rotary pumps (2) per revolution, 17 gallons.

The quantity of water pumped each year since the works commenced supplying water has been as follows:

1873.....	142,477,725 gallons.	1887.....	827,195,009 gallons.
1874.....	294,714,798 "	1888.....	872,990 164 "
1875	416,756,579 "	1889.....	944,472,747 "
1876	518,197,129 "	1890.....	988,771,453 "
1877.....	538 847,186 "	1891.	1,014,475,024 "
1878.....	530,197,397 "	1892	962,953,662 "
1879.....	672,344,128 "	1893.....	1,044,256,236 "
1880.....	827,067,372 "	1894	1,024,735,621 "
1881.....	944,382,043 "	1895	1,122,363,460 "
1882.....	775,642,466 "	1896.....	1,009,523,471 "
1883.....	773,942,702 "	1897.....	944,545,290 "
1884..	831,867,463 "	1898.....	1,038,794,253 "
1885.....	836,970,016 "	1899.....	1,118,599,631 "
1886.....	779,761,852 "		



WATER PUMPED, 1899.

Month.	Gaskill Engines.			Quadruplex Engines.			H. P. Engines and Rotary Pumps.			Gallons Pumped	Daily Average.	Fires.					
	Hours Run.	Revolutions.	Gallons Pumped.	Hours Run.	Revolution.	Gallons Pumped.	Hours Run.	Revolutions.	Gallons Pumped.			No. Alarms	Hours Run.	Highest Pressure.	Lowest Pressure.	Average Pressure.	Gallons Pumped.
January...	742.30	761,666	90,638,254	1.30	4,812	264,660	....	.....	.....	90,902,914	2,932,352	16	8.56	70	70	70	1,635,774
February.	670 00	777,981	92,579,739	2.00	4,381	240,955	2 55	13,448	228,616	93,049.310	3,323,190	15	5.55	80	70	72½	1,220,736
March.....	741.40	750,675	89,330.325	2.20	7,531	414,205	.....	.....	.....	89,744,530	2,894,985	14	6.10	70	70	70	1,081,472
April.....	716 40	804,364	95,719,316	3 20	8,373	460,515	3.00	13 071	222,207	96,402.038	3,213,401	18	7.55	70	70	70	1,500,828
May.....	735.50	*814.182	87,020.832	38.55	52,317	2,877,435	3.25	15,132	257,244	90,155.511	2,908,242	20	9.10	75	70	71¼	1,815,911
June.....	718 30	807,354	96,075,126	1.30	3,249	178,695	2.10	8,539	145,163	96,398.984	3,213,299	10	1.42	70	70	70	345,100
July.....	744 00	767,181	91.294,539	.....	.....	.....	.....	.....	.....	91,294,539	2,944,985	11	6 19	70	70	70	1,084,098
August....	741.00	908,080	108,061,520	3 00	5.869	322,795	3 00	15,178	258,026	108,642,341	3,504,592	15	7.39	70	70	70	1,509,872
September	718.00	787,379	93,698,101	2.00	3,546	195,080	2.00	7,718	131,206	94,024,337	3,134,145	20	7.45	70	60	69	1 439,305
October...	744.00	761,408	90,607,552	.....	.....	.....	1.50	7,125	121,125	90,728,677	2,926,732	10	11.24	80	70	74¾	2,203,863
November	720.00	727,964	86,627.716	.....	.....	.....	.....	.....	.....	86,627,716	2,887,591	14	7 32	80	60	69	1,269,611
December.	744.00	761,586	90,628 734	.....	.....	.....	.....	.....	.....	90,628,734	2,923,508	13	7.56	80	70	74 9/16	1,512,371
Totals ..	8,736 10	9,420,820	1,112,981,754	51.35	90,078	4,954,290	18 20	80,211	1,367,587	1,118,509,631	.....	176	88.23	80	60	71¼	16,598,941

* In May the right Gaskill engine and pump were run 48¾ hours with the left engine and pump shut down, making 78,375 revolutions.
In the same month the left Gaskill and pump were run 10 hours with the right engine and pump shut down, making 87,454 revolutions.
Greatest quantity of water pumped in one day, 3,926,742 gallons, February 13th.
Least quantity of water pumped in one day, 2,566,912 gallons, January 16th
Daily average for the year 3,051,667 gallons

MAIN DISTRIBUTION.

The amount expended during the year on account of the extension of the main distribution was $7,787.49, as follows:

1,500 feet, 15 tons 63 lbs. 4 inch cast iron pipe @ $26.60 per ton	$ 399 83
1,200 feet, 19 " 1,744 " 6 " " " " @ $18.30 " "	363 66
1,932 " 31 " 1,325 " 6 " " " " @ $26.60 " "	842 23
3,168 " 87 " 995 " 8 " " " " @ $18.00 " "	1,574 95
1,872 " 62 " 1,772 " 10 " " " " @ $18.00 " "	1,131 95
31 pieces, 6,391 lbs. special castings	136 39
One 10 in. x 8-in. patent branch used in Center avenue in 1898	25 00
One 8-in. Galvin valve used in Center avenue in 1898	13 50
One 10-in. Flower valve	21 67
Ten 6-in. " "	103 24
Two 6-in. Galvin "	20 00
Twenty-four valve and service boxes	50 77
Six 3 way Galvin hydrants	220 00
Unloading 219 tons, 913 lbs. pipe	76 46
10,535 lbs. pig lead	485 47
442 lbs. jute packing	23 02
Labor, trenching and back filling	1,627 75
Labor, caulking joints	193 75
Drayage on pipe and tools	33 00
Moving dirt and sand for back filling under pavement	113 05
Sand used in Center avenue in 1898	18 25
Connecting up old services with new mains	253 17
Service connections	3 10
Pipe connections for temporary use	12 23
92 bushels coke for melting lead	7 15
Tools and repairing tools	37 00
	$7,787 49

The main pipes of the distributing system have been extended as follows:

On "Ridge Road" from Park avenue to St. Patrick cemetery. On McLellan street from Third street to Center avenue.

Old mains have been replaced by new cast iron mains as follows:

In alley between Jefferson street and Madison avenue, from Second to Tenth street. On Harrison street from Cass avenue to Forty-first street. In Second street, crossing Jackson street.

In Center avenue at southeast corner of Center and Washington avenues, supply to fire hydrant. In Water street from Fifth avenue to a point between Second and Third street.

The total length of pipe laid during the year was:

10-inch cast iron	1,939 feet
8-inch " "	3,568 "
6-inch " "	2,900½ "
4-inch " "	1,594½ "
	9,992 "

The length of pipe taken out or abandoned was:

10-inch cast iron	7½ feet	
8-inch " "	79½ "	
6-inch " "	11½ "	
4-inch " "	78 "	
Total cast iron		176½ feet
10-inch Wyckoff pipe	270 feet	
8-inch " "	5,553½ "	
6-inch " "	699 "	
4-inch " "	278¼ "	
Total Wyckoff pipe		6,800¾ feet
Total mains taken out or abandoned		6,977¼ feet

Total length of distributing mains in service December 31st, 1899, 235,220$\frac{6}{12}$ feet.

The number of stop valves set in the distributing system during the year was:

10-inch Flower valve	1
8-inch " "	3
6-inch " "	6
6-inch Galvin "	2
4-inch Flower "	14
4-inch Galvin "	2
Total	28

The number of stop valves taken out or abandoned was:

8-inch Flower valve	4
4-inch Flower valve	18
4-inch Galvin valve	2
Total	24

Total number of stop valves in service December 31st, 1899, 691.

The number of fire hydrants set during the year was:

Galvin 6-inch inlet, 3 hose nozzles	6
Holly 4-inch inlet, 2 hose nozzles	13
Matthews 4-inch inlet, 2 hose nozzles	1
Total	20

The number of fire hydrants taken out was:

Holly 4-inch inlet, 2 hose nozzles	16
Matthews 4-inch inlet, 2 hose nozzles	2
Total	18

Total number of fire hydrants in service December 31st, 1899, 406.

The fire hydrants along the line of the alley between Jefferson street and Madison avenue from Secoud street to Tenth street were taken out and reset on the new main, the only change of location being to change those formerly located on the south side of intersecting streets to the north side of the same streets.

The Holly hydrants on Harrison street from Cass avenue to Forty-first street were taken out and 6-inch Galvin hydrants with three hose nozzles were placed at each intersecting street.

The Holly hydrants in Water street from Third street to Fifth avenue were taken out and reset on the new main in the same location as before.

The two Matthews hydrants in Second street, one at the corner of Madison avenue, and one at the corner of Jackson street, were taken out; the one at Jackson street being reset on new main in the same location as before; the one on Madison avenue will not be replaced until the main is replaced, which will be early in the coming season.

Two of the Holly hydrants taken out in Harrison street, and one taken out in 1898 on Center avenue, at Farragut street, were set on new lines of pipe as follows:

One at the northeast corner of Fourth and McLellan streets.

One at the northeast corner of Fifth and McLellan streets.

One on the Ridge Road at the center of Green avenue.

Main Pipe in Service December 31st, 1899.

	CAST IRON.	WYCKOFF PATENT.	TOTAL.
20-inch	9,563 ft.	.....	9,563 ft.
16-inch	13,778 ft.	.....	13,778 ft.
12-inch	9,083 ft.	.....	9,083 ft.
10-inch	13,258 ft. 6 in.	27,641 ft.	40,899 ft. 6 in.
8-inch	18,543 ft. 10 in.	18,012 ft. 7 in.	36,556 ft. 5 in.
6-inch	20,910 ft. 6 in.	80,800 ft.	101,710 ft. 6 in.
4-inch	3,048 ft. 3 in.	20,263 ft.	23,311 ft. 3 in.
3-inch	.....	319 ft.	319 ft.
Total	88,185 ft. 1 in.	147,035 ft. 7 in.	235,220 ft. 8 in.

Total cast iron mains ..... 16 miles, 3,705 feet.
Total Wyckoff mains ..... 27 miles, 4,475 feet.
Total mains ..... 44 miles, 2,900 feet.

Percentage of each size of pipe:

20 inches	4.07 per cent.
16 inches	5.86 per cent.
12 inches	3.86 per cent.
10 inches	17.39 per cent.
8 inches	15.54 per cent.
6 inches	43.24 per cent.
4 inches	9.91 per cent.
3 inches	.13 per cent.
	100.00

Valves in Service December 31st, 1899.

	20-in.	16-in.	12-in.	10-in.	8 in.	6-in.	4-in.	3-in.	Total
Flower Patent	4	9	3	38	55	184	331	3	627
Galvin Patent	.....	.....	2	.....	.....	6	43	.....	51
Eddy Patent	.....	.....	.....	.....	.....	5	6	.....	11
Brown Patent	.....	.....	1	.....	.....	1	.....	.....	2
Total	4	9	6	38	55	196	380	3	691

Blow-off gates included in above:

Three ..... 6-inch.
Eleven ..... 4-inch.
Two ..... 3-inch.

Fire hydrants in service December 31st, 1899:

Matthews, 6-inch inlet, 3 hose nozzles, gated	32
Matthews, 4-inch inlet, 2 hose nozzles	203
Bourbon, 6-inch inlet, 3 hose nozzles, gated	5
Bourbon, 4-inch inlet, 2 hose nozzles	10
Holly, 4-inch inlet, 2 hose nozzles	129
Gaskill, 4-inch inlet, 2 hose nozzles	16
Galvin, 6-inch inlet, 3 hose nozzles, gated	6
Galvin, 4-inch inlet, 2 hose nozzles	4
Morgan, 4-inch inlet, 2 hose nozzles	1
	406

WATER METERS.

The amount expended during the year on account of the extension of the meter system was $342.74, as follows:

34 new meters purchased	$286 30
Meter fittings and setting meters	56 44
	$342 74

The new meters bought were:

5 ⅝-inch Hersey Disc, cost	$ 42 79
6 ⅝-inch Pittsburg Disc, cost	48 55
11 ⅝-inch Nash, cost	93 39
12 ⅝-inch Trident, cost	101 57
	$286 30

The number of meters set during the year 56, and the number taken out, 7. Whole number of meters in service December 31st, 1899, 775.

The cost of the meter system to December 31st, 1899, has been $18,474.56, as follows:

775 meters in service cost set	$16,427 05
35 meters in stock cost	1,150 76
Value of meter fittings in stock	68 55
Labor, etc., on 106 meters and indicators taken out and not replaced	828 20
	$18,474 56
Domestic meters	672
Manufacturing meters	103

Meters Set in 1899.

	3 in.	1-in.	¾-in.	⅝-in.	½-in.	⅜-in.	Total.
Union Rotary	2	.....	1	.....	.....	.....	3
Crown	.....	.....	1	.....	1	2	4
Empire	.....	1	.....	.....	.....	.....	1
Empire A	.....	.....	.....	5	.....	.....	5
Empire A A	.....	.....	.....	2	.....	.....	2
Nash	.....	.....	.....	9	.....	.....	9
Hersey Disc	.....	...	.....	6	.....	.....	6
Thomson	.....	.....	.....	5	.....	.....	5
Thomson Bee	.....	.....	.....	.....	2	.....	2
Thomson Lambert	.....	.....	.....	1	.....	.....	1
Trident	.....	.....	.....	12	.....	.....	12
Pittsburg Disc	.....	.....	.....	6	.....	.....	6
Total	2	1	2	46	3	2	56

Meters Taken Out in 1899.

	3-in.	⅝-in.	⅜-in.	Total.
Union Rotary	2	1	.....	3
Crown	.....	.....	2	2
Empire A	.....	1	.....	1
Worthington	.....	1	.....	1
Total	2	3	2	7

Meters in Stock December 31st, 1899.

	3-in.	2-in.	1½-in	1-in.	¾-in.	⅝-in.	½-in.	⅜-in.	Total.
Union Rotary	5	1	....	1	....	1	....	....	8
Union Duplex	....	....	....	....	....	3	....	....	3
Crown	....	....	....	2	1	....	....	1	4
Empire	....	...	....	2	3	....	5	....	10
Empire A	.. .	....	....	....	....	1	....	....	1
Nash	....	....	....	....	....	2	....	....	2
Worthington	....	....	3	....	....	1	....	....	3
Thomson	....	....	....	....	2	....	....	....	2
Westinghouse	....	....	....	....	....	2	....	....	2
Total	5	1	2	5	6	10	5	1	35

Meters in Service December 31st, 1899.

	8-in.	6-in.	4-in.	3-in.	2 in.	1½-in.	1-in.	¾-in.	⅝-in.	½-in.	⅜-in.	Total.
Union Rotary	1	1	6	16	5	4	2	1	41	.....	.. . .	77
Union Duplex	....	...	....	....	.....	.....	.....	.....	19	.....	.....	19
Columbia	....	....	....	....	.....	.....	.....	.....	23	.....	.....	23
Crown	....	....	....	....	.....	1	23	33	.....	28	41	126
Empire	....	....	....	....	.....	.....	4	32	.....	20	.....	56
Empire A	....	....	....	...	.....	.....	.....	.....	10	.....	.....	10
Empire AA	....	....	....	....	.....	.....	.....	.....	39	.. ..	.....	39
Nash	....	....	....	....	.....	.....	.....	.....	29	....	...	29
Gem	....	....	....	....	1	.....	.....	.....	.....	.....	.....	1
Worthington	....	....	....	....	7	4	.....	.....	15	.....	.....	26
Hersey	...	....	....	....	.....	.....	2	5	26	.....	.....	33
Hersey Disc	....	....	....	....	.....	.....	.....	.....	36	.....	.....	36
Thomson	....	....	....	....	.....	.....	2	.....	102	.....	.....	104
Thomson Bee	....	....	....	....	.....	.....	.....	.....	18	72	.....	90
Thomson Lambert	....	...	....	..	.....	.....	.....	.....	24	.....	.....	24
Trident	....	....	....	....	.....	.....	.....	.....	72	.....	.....	72
Westinghouse	....	....	....	....	.....	.....	.....	.....	4	.....	.....	4
Pittsburg Disc	....	....	....	....	... .	.....	.....	...	6	.....	.....	6
Total	1	1	6	16	13	9	33	71	464	120	41	775

GENERAL MAINTENANCE AND REPAIRS.

The extremely cold weather of January, February and March, with no snow on the ground to protect the pipes and hydrants, caused a large increase in the cost of maintaining the distribution system. This city was more fortunate than a majority of the cities of this country in or near this latitude in having none of its main pipes frozen, but the damage to fire hydrants and water meters caused by frost was no small item, and a large number of service pipes were frozen. From the 10th of January until the middle of March, two men and some of the time three, were employed almost constantly in testing hydrants and looking after frozen meters. During this time 113 fire hydrants were found frozen to such an extent as would have seriously interfered with their use by the fire department had such use been required: but the constant watchfulness of the employees of this department, and the promptness with which the trouble was removed when found, enabled the fire department to perform its work without any material delay caused by frozen hydrants.

One large item in the cost of repairs to the main distribution was due to a crack in the 20-inch cast iron main on Water street, near the plant of the Michigan Pipe Company. The water pipe is laid parallel with the main line of the Michigan Central belt line railroad tracks, and about four feet south of the south rail of said tracks. The pipe was laid in made ground, and owing to the high water in the river at the time it was laid (in 1891), and the consequent flooding of the trench, it was placed at somewhat less than the usual depth, so that there was less than three feet cover over the top of the pipe. Soon after this pipe was laid, the Michigan Central railroad company put in a spur track to the plant of the Michigan Pipe Company, the south rail of the spur crossing the line of water pipe immediately over the point where the crack occurred; the crack being on the bottom of the pipe, running nearly half way around, and almost directly around the pipe. It was evidently caused by the weight of the heavy locomotives passing around the curve of the spur, and the want

of firm support under the pipe at this point. The crack was repaired by placing a split sleeve over it, and to avoid further trouble at this point, the pipe was lowered about fifteen inches to a firm foundation in solid clay soil. The pipe was lowered with jack bolts and chains from timbers across the ditch without interrupting the supply of water through it; the pipe being left at its original grade about 100 feet each way from the point of maximum depression.

The 10-inch cast iron main in Water street at 16th street was raised about two feet to make way for a large brick sewer; owing to the close proximity of branches from this pipe on each side of the line of the sewer, this pipe could not be raised in the same manner that the 20-inch pipe was lowered, but the main had to be cut and ⅛ bends used to carry it over the sewer.

The fire hydrant at the corner of 29th and Water streets was broken by a derailed car, which left the tracks of the Michigan Central belt line railroad. The expense of repairing this hydrant was repaid to this department by the Michigan Central railroad company.

Two other fire hydrants were broken by heavily loaded wagons coming in collision with them; one on Water street between Tenth and Eleventh streets was broken in the night, and before the water could be shut off the street was flooded to such an extent that nearly 300 feet in length of the cedar block pavement had to be relaid.

The work of cleaning out the inlet cut at the bay was resumed where it was left in 1896, causing an addition of about $2,000.00 to the ordinary operating expenses.

The cost of maintenance and repairs, not including the expense of maintenance and operation of pumping engines, was $8,065.18, as follows:

Salary of superintendent and secretary	$1,800 00
Salary of office assistant	800 00
Office expenses	271 55
Repairs on main distribution	891 92
Repairs and care of services	374 59
Repairs and care of water meters	781 84
Repairs and care of inlet works	2,759 04
Service connections	92 23
Repairs to engine house and grounds	294 02
	$8,065 18

Office Expenses.

The expenses of the office were:

For blank books, printing and stationary	$ 155 45
For postage stamps and postal cards	94 40
For telegrams, telephone service, stamps and drafts	11 55
For dials for recording gage in office	5 65
For drayage on old furniture	2 00
For carriages for funeral	2 50
	$ 271 55

Repairs on Main Distribution.

The number of leaks in the main pipes during the year was 57, of which three were in the cast iron mains and 54 in the Wyckoff mains. Two of the leaks in the cast iron mains were lead joints, repaired by recaulking the lead, and one was the crack in the 20-inch main before mentioned.

Thirteen leaks in the Wyckoff mains were burst pipe, 39 were joint leaks, and two were knot holes. Amount expended for repairs on main distribution, $891.92, as follows:

Labor on hydrants, testing and repairing	$270 20
Parts of hydrants from manufacturers for repairs	122 28
Labor on valves and valve boxes	17 50
Labor repairing 54 leaks in Wyckoff mains	217 38
Pipe for repairing Wyckoff mains	55 05
Labor repairing three leaks in cast iron mains	46 62
20-inch sleeve and clamp	20 11
Labor lowering 20-inch main	54 77
Labor raising 10-inch main	11 25
Four 10-inch ⅛ bends	21 90
Labor moving hydrants, leveling trenches, etc	22 40
Tools and repairing tools	32 46
	$891 92

Repairs and Care of Services.

Thirteen leaks in small Wyckoff private mains, each supplying a number of consumers, have been repaired by this department, and nine lead service pipes have also been repaired without expense to the consumer where the indications were that the break was caused by the work of this or some other department of the city government.

335 services have been shut off by employees of this department and 331 opened. Of the services shut off 47 were shut at the request of the consumer; 21 for non-payment of water rates;

35 for leakage; 4 found frozen; 132 premises found vacant; 95 not used during winter months, principally hose for sprinkling only; and one on account of premises being supplied from another service.

The amount expended for repairs and care of services was $374.59, as follows:

Turning on and off water	$213 25
Labor repairing 13 private Wyckoff mains	34 37
Pipe used in repairing private mains	10 57
Repairing nine lead services	25 15
Changing seven service connections	9 00
Examining services and serving notices	82 25
	$374 59

Repairs and Care of Water Meters.

Thirty-six meters were found frozen, all but one of which were repaired with parts ordered from the manufacturers. One was so seriously injured as to render it necessary to send it to the makers for repairs.

In addition to the 36 meters injured by frost, 130 have been repaired by employees of this department. 112 meters not broken, but not registering properly, have been taken out and cleaned and replaced. All meters brought to the shop are tested for accuracy, and if they can be repaired so that they will register between 95 per cent. and 100 per cent. of the water passing through them, they are returned to service.

The amount expended on the repairs and care of water meters was $781.84, as follows:

Reading and inspecting meters	$229 50
Repairing meters	304 75
Parts of meters from manufacturers for repairs	79 28
Repairing meter boxes	57 00
Cleaning stuck meters	79 25
Moving and changing meters	13 28
Sewering meter boxes and packing meters	6 68
Tools and repairing tools	12 10
	$781 84

Service Connections.

The number of service connections made with the main pipes during the year was 173, of which 168 were made with corporation cocks, and five with branch castings for large services. 113 connections were made with new mains to connect services formerly connected with old mains, and were made without expense to consumers; six were made to replace old connections taken out on account of leakage, and were also made without expense to consumer; three were made to connect old services with main pipes, such services having been previously supplied off from small private mains, and 50 were for new supply to new premises.

The number of service connections taken out or permanently abandoned (main discontinued) during the year was 155, of which three were branch connections for large services and 152 were corporation stops. Fifteen connections heretofore reported abandoned are among those enumerated as taken out during the year.

Two connections heretofore reported as abandoned have been renewed, and services again connected with them, and four connections have been abandoned but not removed or permanently discontinued.

The whole number of service connections in the main pipes December 31st, 1899, was 2,052; the service connections put in in 1899 were:

	Branches.			Corporation Stops.				Total
	8″	6″	4″	1″	¾″	⅝″	½″	
In cast iron mains	1	1	3	9	10	54	55	133
In Wyckoff mains	....	....	....	1	5	12	22	40
Total	1	1	3	10	15	66	77	173

The service connections taken out or permanently abandoned (main discontinued) during the year were:

	Branches.			Corporation Stops.					Total.
	8″	4″	2″	1¼″	1″	¾″	⅝″	½″	
In cast iron mains				1			1	...	2
In Wyckoff mains	2	1	1	....	26	46	14	63	153
Total	2	1	1	1	26	46	15	63	155

Service connections in main pipes December 31st, 1899:

	Branches.					Corporation Stops.						Total
	8″	6″	4″	3″	2″	2″	1¼″	1″	¾″	⅝″	½″	⅜″	
In cast iron mains	2	6	14	3	4	2	3	68	111	164	201	5	583
In Wyckoff mains	....	2	13	1	2	....	...	135	349	423	538	6	1,469
Total	2	8	27	4	6	2	3	203	460	587	739	11	2,052

The service connections abandoned, but not taken out are:

	Branches.	Corporation Stops.					Total
	4″	1″	¾″	⅝″	½″	⅜″	
In cast iron mains	1	9	10	3	12	4	39
In Wyckoff mains	3	14	20	9	21	....	67
Total	4	23	30	12	33	4	106

Total service connections in use 1,946
Total number of separate services supplied 2,159

The number of services open December 31st, 1899, was 1,542, and the number shut off 617.

The services shut off are closed for the following reasons:

Buildings or plumbing not completed	22
Premises unoccupied	90
For winter months (used in summer only)	144
Vacant lots	72
Request of consumers	137
Leakage	11
Non-payment of water rates	141
	617

This enumeration of services does not include those connected with the 106 taps reported as abandoned, and most of which are shut at the main pipe, but which may at any time be renewed.

Repairs and Care of Inlet Works.

Early in May a contract was made with the Bay City Dredging Company for the removal of the sediment in the inlet cut, from the receiving basin to the open bay. As the removal of this sediment with a dipper dredge would roil the water to such an extent as to make it impossible to supply the city from that source while the work was in progress, the contractors built a suction dredge, placing a 12-inch centrifugal pump with boiler and engines to operate the same, on a small lighter. This machine was to a certain extent experimental, both with the contractors and this department. The result of its operations demonstrated the practicability of removing the sediment in this manner without disturbing the purity of the supply to the city, but the presence of sticks, stones, bark, grass, etc., embedded in the sediment seriously interfered with the progress of the work. The price paid per cubic yard for the removal of this material was 15 cents, and the quantity taken out under the contract was 10,200 cubic yards, in addition to which the dredge worked 11½ days cleaning out that portion of the cut which was cleaned by hand four years ago, and where the sediment was of such a character as to render it impossible to measure it accur-

ately in places. The price paid per day was $35.00, and the quantity taken out under these conditions was approximately 2,000 cubic yards.

The removal of this material produced a channel about 30 feet wide the entire length of the cut, in which the depth of water at its ordinary stage is about 5 feet in the most shallow portions of the cut.

There remains about 20,000 cubic yards of sediment to be removed to clear the cut to its original dimensions.

Three leaks were found in the inlet pipe, where surface water was making its way into the pipe. These leaks were found to be small openings between the staves at the junction of different sections of pipe, which were easily repaired by caulking. The continued rise in the level of the water in the bay, rendered it necessary to raise the broken stone facing on the banks of the inlet cut, and this has now been brought up to the top of the banks.

The entire amount expended during the year on the repairs and care of inlet works was $2,759.04, as follows :

Salary of reservoir keeper	$ 420 00	
Rent of telephone at bay	12 00	
Repairing three leaks in inlet pipe	54 32	
Leveling up old ditch over inlet pipe	91 50	
Repairing brick lining in basin	19 90	
Raising stone facing on inlet cut	80 00	
Grading banks of cut	63 17	
Clearing grass, etc., from inlet cut	75 00	
Dredging in inlet cut	1,931 91	
Repairs to river inlet	7 39	
Tools and repairing tools	3 85	
		$2,759 04

Repairs to Engine House and Engine House Grounds.

The engine house has been wired for lighting by electricity from the city electric light plant. The wiring of the building was done by order of the board of electric control at the expense of the city, but some extensions have since been required, the material for which has been purchased by this department, but put in by the lineman of the city fire department without expense.

Wire screens have been placed in the wells over the openings leading from the outside wells to the well under the engine house.

A toilet room has been partitioned off in the engine room and suitably furnished.

The renewal of the smoke flue from No. 4 and 5 boilers rendered it necessary to tear out and rebuild some of the brick work of the smoke stack, and the outside walls of the engine house have required some repairs.

Brick floors laid with paving brick have been placed in front of all of the boilers, and the balance of the floor in boiler room has been entirely replanked.

The roof of the coal sheds has been repainted two coats.

The cinders from the furnaces are used for filling in and leveling up the grounds in the rear of the engine house, and a man is employed at intervals to grade these cinders and fill up the driveways through the grounds.

The amount expended for repairs to engine house and grounds was $294.02, as follows:

Repairs to brick walls of engine house and stack	$ 16 48
Painting roof of coal sheds	6 70
Toilet room in engine house	61 74
Electric wiring	6 86
Repairs to windows of engine room	2 65
Brick floor in front of boilers	20 97
Repairing plank floor in boiler room	14 41
Repairs to engine house sewer	16 87
S reens for wells	12 36
Platform in wells	6 68
Cleaning wells	14 27
Grading cinders on yard	44 17
	$294 02

The total cost of maintaining and operating the water works, including the interest on water works bonds paid by the city, was $39,076.97.

The water works department is entitled to credits as follows:

For water rates collected	$22,508 97
For miscellaneous collections (not on construction)	306 87

FOR WATER SUPPLIED CITY USES.

City electric light plant	300 00
12 drinking fountains and four ornamental fountains	2,400 00
City hall	200 00
Six hose houses	150 00
406 fire hydrants @ $45.00 each	18,270 00
Flushing sewers	2,000 00
Sprinkling public parks	150 00
Total credits	$46,340 84

All of which is respectfully submitted.

E. L. DUNBAR,

Superintendent and Secretary.

Office Board of Water Works, Bay City, February 27, 1900.



Summary of Statistics.

REPORT FOR 1899.

Water Works of Bay City, Michigan.
Built in 1872.
Owned by city.
Source of supply, Saginaw Bay, an arm of Lake Huron.
Mode of supply, direct pumping.

PUMPING.

1. Builders of pumping machinery, Holly Manufacturing Company.
2. Fuel used, bituminous slack coal.
3. Coal consumed for year, 4,040,535 lbs.
4. Wood consumed for year, $\frac{22,000}{3}$ 7,333 lbs.
5. Total fuel consumed, 4,047,868 lbs.
6. Total pumpage for year, 1,118,599,631 gallons.
8. Average dynamic head, 113 feet.
9. Number of gallons pumped per pound of coal, 276.
10. Duty $\frac{1,118,599,631 \times 834 \times 100 \times 113}{4,047,868}$ 26,043,160.
    Cost of pumping based on total pumping station expenses. $7,694.42.
11. Per million gallons pumped, $6.88.
12. Per million gallons raised 100 feet, $6.09.
    Cost of pumping based on total maintenance, including interest, $39,076.97.
13. Per million gallons pumped, $34.93.
14. Per million gallons raised 100 feet, $30.91.

CONSUMPTION.

1. Estimated population to date, 34,000.
2. Estimated population on pipe lines, 22,000.
3. Estimated population supplied, 17,000.
4. Total gallons supplied, 1,118,599,631.

5. Passed through domestic meters, 62,752,551 gallons, $5\frac{61}{100}$ per cent.

6. Passed through manufacturing meters, 126,089,387 gallons, $11\frac{27}{100}$ per cent.

7. Average daily consumption, 3,064,657 gallons.

8. Gallons per day to each inhabitant, 90.

9. Gallons per day to each consumer, 180.

10. Gallons per day to each service (distribution 22), 1,419.

DISTRIBUTION—MAINS.

1. Material, cast iron and Wyckoff patent wood pipe.

2. Size, 3 inch to 20 inch.

3. Extended, 9,922 feet.

4. Discontinued, 6,977¼ feet.

5. Total in use, 44 miles 2,900 feet.

6. Cost of repairs per mile, $20.21.

7. Leaks per mile, $1\frac{25}{100}$.

8. Small distribution less than 4 inches, 319 feet.

9. Hydrants added, 2.

10. Number in use, 406.

11. Stop gates added, 4.

12. Number in use, 691.

13. Number of small gates less than 4 inch, 3.

14. Number of blow-off gates, 16.

15. Ranges of pressure (domestic) day and night, 35 to 38 pounds.

SERVICES.

16. Material, lead, wrought iron, cast iron and Wyckoff.

17. Sizes, ⅜-inch to 8-inch.

21. Services added, 43.

22. Number of services in use, 2,159.

23. Meters added, 49.

26. Number in use, 775.

Financial—Maintenance.

RECEIPTS—DIVISION I.				EXPENDITURES.			
	From consumers—			AA.	Management and r pairs	$15,886 97	
A.	Water rates, domestic	$16,777 44		BB.	Interest on bonds	23,190 00	
B.	Water rates, manufacturing	5,726 53		CC.	Total maintenance		$39,076 97
C.	Net receipts from water		$22,503 97	DD.	Balance to construction		6,883 87
D.	Miscellaneous service connections, etc		266 87				
E	Total receipts from maintenance		$22,770 84		EE. Total		$45,960 84
	From public funds						
J.	Tax levy for interest		$23,190 00				
	K. Total		$45,960 84				
	DIVISION II.						
	From fixed rates—						
L.	Domestic	$ 8,941 63					
M.	Manufacturing	616 43					
N.	Total fixed rates		$ 9,558 06				
	From meter rates—						
O.	Domestic	$ 7,535 81					
P.	Manufacturing	5,110 10					
Q.	Total meter rates		$12,945 91				

Construction.

R.	Balance from former years	$12,850 43		FF.	Extension of mains	$ 7,787 19	
	Balance from maintenance	6,883 87		HH.	Water meters	342 74	
U.	From main distribution	184 81		II.	Total construction		$ 8,130 23
	From furniture and fixtures	109 00		JJ.	Balance		11,897 88
			$20,028 11				$20,028 11
	Net cost of works to date		$87,802 48		Bonded debt		$50,000 00

Uses Supplied at Fixed Rates January 1st, 1900.

Antomatic Sprinklers	3	Hose for Sprinkling	215
Boarding Houses	3	Knitting Factory	1
Butcher Shops	7	Mattress Factory	1
Bakeries	3	Meat Warehouse	1
Barber Shops	6	Meat Market	3
Blacksmith Shops	2	Offices	23
Bicycle Repair Shop	1	Plumbing Shops	2
Bottling Works	6	Photograph Galleries	4
Baths (public)	1	Printing Offices	3
Baths (Turkish)	1	Pawn Shops	2
Business Blocks	8	Passenger Depot	1
Banks	2	Plating Works	1
Boilers (power)	5	Restaurants	8
Bowling Alley	1	Schools	15
Baths (private)	141	Stone Yard	1
Chicory Factory	1	Saloons	33
Clothes Cleaning	2	Stores	62
Carriage Shops	2	Skating Rink	1
Churches	5	Stables (mill)	4
Cigar Factories	2	Stable (hotel)	1
Dwellings	565	Stables (livery)	4
Dye Works	1	Stables (private)	70
Express Office	1	Telegraph Office	1
Fire Pipes	2	Telephone Exchange	2
Gas Works	1	Tin Shop	1
Green Houses	2	Tailor Shop	1
Gas Engines	3	Undertakers' Rooms	2
Hotels	11	Water Motor Pumps	3
Halls (public)	7	Warehouses	1
Harness Shop	2	Water Closets and Urinals	585

Uses Supplied Through Meters January 1, 1900.

Automatic Sprinklers	2	Hotels	14
Ashery	1	Halls (public)	11
Banks	3	Hose for Sprinkling	46
Bakeries	4	Kindling Factories	2
Bath Rooms (public)	1	Laundries	5
Bicycle Factory	1	Locomotive Round House and Tank	1
Boarding Houses	9	Locomotive Stand Pipe	1
Boiler Shops	4	Machine Shops	7
Bottling Works	4	Masonic Temple	1
Box Factories	4	Offices	32
Brewery	1	Opera House	1
Business Blocks	27	Planing Mills	11
Business College	1	Passenger Depots	2
Butcher Shops	5	Photograph Gallery	1
Barber Shops	2	Plumbers' Shop	1
Boilers (power)	52	Pipe Factory	1
Blacksmith Shop	1	Plow Factory	1
Baths (private)	409	Printing Offices	4
Creamery Package Factory	1	Paint Shop	1
Carpenter Shop	1	Railroad Coach Yard	1
Carpet Cleaning	1	Restaurants	2
Cemetery	1	Stores	62
Churches	6	Sausage Factory	1
Club Rooms	2	Stables (private)	103
Coal and Wood Yards	2	Stable (bus and hack)	1
County Jail	1	Stables (hotel)	3
County Court House	1	Stables (mill)	4
Cracker Factory	1	Stables (livery)	7
Cross Arm Factory	1	Stable (street car)	1
Crystal Water Works	1	Saloons	12
Canning Works	1	Salt Blocks	4
Chemical Works	1	Saw Mills	8
Drill Houses	3	Sash and Door Factories	2
Drainage Pump	1	Schools	2
Dwellings	539	Stave and Heading Factory	1
Elevator Tanks	5	Shade Roller Factory	1
Electric Light Works	1	Telephone Exchange	1
Freight Depot	1	Telegraph Office	1
Fire Pipes	19	Tin Shop	1
Flouring Mills	2	Woodenware Works	1
Foundries	5	Water Motors	73
Government Building	1	Water Closets and Urinals	129
Green Houses	4	Ware House	1
Gas Engines	3		

City Uses for Which no Payment is Made.

1 City Hall.
6 Steamer, Truck and Hose Houses, 20 Horses, 2 Steamers and 1 Chemical.
1 Electric Light Station, 3 Boilers.
30 Water Closets and Urinals in City Buildings.
6 Baths in City Buildings.
12 Public Watering Troughs.
4 Ornamental Fountains.
10 Lawn Hose, for Sprinkling Parks.
2 Street Sprinkler Carts.
406 Public Fire Hydrants.

Uses Shut Off January 1st, 1900.

Armory	1	Harness Shops	2
Boarding Houses	5	Laundries	1
Baths (private)	30	Market Garden	1
Blacksmith Shops	6	Machine Shop	1
Blocks	3	Mortar Yard	1
Barber Shops	4	Offices	3
Butcher Shop	1	Printing Office	1
Boiler Shops	2	Plumbing Shop	1
Broom Factory	1	Planing Mill	1
Bakery	1	Pasture	1
Creamery	1	Round Hoop Factory	1
Church	1	Stave and Heading Factory	1
Carpet Cleaning	1	Stores	50
Cemeteries	4	Saloons	11
Carriage Shop	1	Saw Mill	1
Dry Kiln	1	Salt Block	1
Dwellings	245	Stone Yard	1
Excelsior Works	1	Stables (private)	30
Fire Pipes	6	Stable (livery)	1
Fish Market	1	Vacant Lots	77
Fair Grounds	1	Water Motors	1
Flour Mill	1	Ware Houses	3
Hose for Sprinkling	181	Water Closets and Urinals	105
Hotels	13		

Contents

Bay City

Michigan

TWENTY-NINTH

ANNUAL REPORT

of the

Water Department

DECEMBER

THIRTY-FIRST

1900

TWENTY-NINTH

ANNUAL REPORT

—OF THE—

WATER DEPARTMENT

—OF—

BAY CITY, MICHIGAN.

December 31st, 1900.

BAY CITY, MICH.
PRESS OF C. & J. GREGORY CO.
1901.

Water Department.

1901.

COMMISSIONERS.

G. HENRY SHEARER, PRESIDENT.
(Term Expires Sept. 6th, 1902.)

ARTHUR F. BROOKMAN.
(Term Expires Sept. 6th, 1901.)

BENJAMIN F. RAY.
(Term Expires Sept. 6th, 1903.)

ROBERT E. BOUSFIELD.
(Term Expires Sept 6th, 1904.)

HOMER E. BUCK.
(Term Expires Sept. 6th, 1905.)

WALTER S. COUSINS.
(Term Expires Sept. 6th, 1906.)

ARTHUR H. INGRAHAM.
(Term Expires Sept. 6th, 1907.

DEPARTMENT OFFICERS AND EMPLOYEES.

E. L. DUNBAR.....Supt. and Secy.
T. A. DALZELL.....Office Assistant.
FRANK H. COLLINS.....Inspector.
THOMAS LARDNER.....Turnkey.
LEVI D. CARPENTER.....Reservoir Keeper.
A. B. VERITY.....First Engineer.
JAS. E. DARLING.....Second Engineer.
JAS. H. MCGIBBONS.....Fireman.
FRANK O'HARE.....Fireman.



WATER WORKS PUMPING STATION.

Superintendent's Report.

To the Honorable the Board of Water Commissioners of Bay City, Michigan:

GENTLEMEN: I have the honor to submit the twenty-ninth annual report of the Water Department, the same being for the year ending December 31st, 1900.

The length of time the river supply has been called upon during the year was about 50 per cent. more than in 1899, but owing to the fact that the average size of the opening has been considerably less, the total quantity of water taken from the river has been a little less than during that year. Until a larger intake from the bay is provided, it will be impossible to avoid the use of river water at all times, and I would advise that immediate steps be taken to provide for the construction of a new intake, the same to be five feet in diameter, and laid from the west shore of the bay to the present pumping station.

The total quantity of water pumped during the year exceeded the quantity pumped in 1899 by about 24 million gallons, but this increase is more than accounted for by the increased quantity of water supplied to the North American Chemical Company, the increase in the quantity supplied to that company being more than 40 million gallons. The contract with the Chemical Company is for a supply not exceeding 500,000 gallons per day. The quantity supplied them during the past year was 116 million gallons, making a daily average for the year of about 64 per cent. of the maximum amount the City agreed to supply them. From August 11th to September 1st, the meter on this supply was read daily; during seven days of the 21 days included between these days, the quantity used was in excess of the contract limit, reaching in excess of 700,000 gallons one day.

There was a little more than two miles of pipe laid during the year, of which nearly one and a quarter miles was to replace old mains taken out or abandoned. There is yet nearly eight miles of the old Wyckoff mains laid previous to 1876 which *must* be replaced as rapidly as possible. If the collections from water rates in excess of the operating expenses can be left under the control of the Board and used for this purpose, they will probably be sufficient to meet the expenditures for this purpose, as they become absolutely necessary. Any change in the method of providing money to meet this expense which will make the matter of replacing these old mains contingent upon the issuing of bonds, or providing for it in any other way, is to be deprecated, and will be almost certain to result in either serious delay to the improvement of our streets, or in permanent pavement being laid over these old mains, which are liable to serious rupture at any moment.

The matter of providing additional pumping machinery will soon demand the attention of the Board. As long as the demand can be kept down near its present limits, the present machinery will supply these demands, but should any new manufactories demanding a large supply of water be introduced into our city, or should there be a material increase in the demand for water for any reason, it will be necessary to provide additional machinery at once.

There is no doubt that the number of meters in use has largely reduced the waste of water in the city and kept down the expenditures thousands of dollars. All new services, where the assessment rate exceeds the minimum rate by meter, and where the fixtures are of such a nature as to render probable a considerable waste of water, are now metered when they are put in, and a few meters are attached to old services each year, but there are still a large number of old services through which there is much waste, and which it would be true economy to place under meter.

FINANCIAL.

Receipts.

The receipts of the department for the year 1900 have been as follows:

From water rates, roll of 1891	$ 5 00	
From water rates, roll of 1893	17 00	
From water rates, roll of 1895	6 25	
From water rates, roll of 1896	2 00	
From water rates, roll of 1897	23 94	
From water rates, roll of 1898	87 80	
From water rates, roll of 1899	1,172 34	
From water rates, roll of 1900	22,801 82	
Total from water rates		$24,116 15
From plumbers' licenses	$ 30 00	
From service connections	174 00	
From service taps sold	16 00	
From repairs on main distribution	16 10	
From repairs on engines and boilers	4 00	
From cast iron pipe	59 14	
From laying pipe	32 67	
Total miscellaneous		331 91
Total receipts		$24,448 06

Receipts by months:

January	$ 1,240 70
February	575 52
March	1,109 00
April	1,750 11
May	954 10
June	1,764 58
July	1,977 51
August	1,051 84
September	1,536 34
October	2,131 49
November	1,234 11
December	9,122 76
	$24,448 06

Expenditures.

The total expenditures for the year 1900 were $25,110.73, for the following accounts:

MAINTENANCE ACCOUNTS.

Office department:

Salaries	$2,600 00	
Office expenses	293 51	

Street and service department:

Repairs on main distribution	784 45	
Repairs and care of services	515 87	
Repairs and care of water meters	841 44	
Service connections	154 97	

Inlet department:

Repairs and care of inlet works	1,095 08	

Pumping department:

Salaries	3,630 00	
Fuel	3,145 53	
Oil, packing and supplies	230 66	
Repairs on engines and boilers	376 74	
Repairs on boiler arches	10 78	

Repairs to buildings, etc.:

Repairs to engine house	193 34	
Repairs to engine house grounds	20 88	
Repairs to house at bay	846 94	
Total for maintenance and operating expenses		$14,739 19

CONSTRUCTION ACCOUNTS.

Water meters:

New meters	$ 617 02	
Setting meters	28 13	

Main distribution:

Cast iron pipe	5,718 10	
Valves	278 51	
Fire hydrants	198 75	
Laying pipe	3,531 03	
Total for construction		10,371 54
Total expenditures		$25,110 73

Ledger Balance for the Year 1900.

Ledger F.	Dr.	Cr.
Folio 82, Water rates, roll of 1900		$22,801 82
" 86, Water rates, roll of 1899		1,172 34
" 84, Water rates, roll of 1898		87 80
" 85, Water rates, roll of 1897		23 94
" 85, Water rates, roll of 1896		2 00
" 85, Water rates, roll of 1895		6 25
" 84, Water rates, roll of 1893		17 00
" 84, Water rates, roll of 1891		5 00
" 86, Plumbers' licenses		30 00
" 94, Service connections		35 03
" 87, City water works fund		662 67
" 88, Office department salaries	$ 2,600 00	
" 89, Office department expenses	293 51	
" 96, Street and service dept., repairs on main distribution	768 35	
" 92, Street and service dept., repairs and care of services	515 87	
" 96, Street and service dept., repairs and care of water meters	841 44	
" 95, Inlet department, repairs and care of inlet works at bay	1,095 08	
" 97, Pumping department, salaries	3,690 00	
" 98, Pumping department, fuel	3,145 53	
" 99, Pumping department, oil, packing and supplies	239 66	
" 100, Pumping department, repairs on engines and boilers	372 74	
" 100, Pumping department, repairs on boiler arches	10 78	
" 102, Repairs to buildings, etc., repairs to engine house	193 34	
" 102, Repairs to buildings, etc., rep'rs to engine house grounds	20 88	
" 101, Repairs to buildings, etc., repairs to house at bay	846 94	
" 103, Water meter account, water meter	614 02	
" 103, Water meter account, setting meters	28 13	
" 104, Main distribution, cast iron pipe	5,658 96	
" 104, Main distribution, valves	278 51	
" 105, Main distribution, fire hydrants	198 75	
" 107, Main distribution, laying pipe	3,498 36	
" 380, Union Water Meter Co	3 00	
	$24,843 85	$24,843 85

Balance Sheet—Bay City Water Works.

December 31, 1900.

Ledger F.	Dr.	Cr.
Folio 1, Bay City bond account ($452,000 bonds)		$443,045 87
" 1, Water assessment (frontage on pipe)		736 07
" 28, Service connections, etc.		3,690 65
" 29, Plumbers' licenses		960 20
" 30, Rents, dockage, etc.		2,627 33
" 32, Water rates		500,659 68

Folio 2,	Construction—	real estate	$ 6,724 83	
" 2,	"	dock, tramway and store shed	1,882 63	
" 3,	"	engine house, chimney and wells	21,401 42	
" 3,	"	engine foundation, boiler foundation and arches	6,777 45	
" 4,	"	pumping machinery	59,427 72	
" 4,	"	inlet from river	4,799 46	
" 5,	"	inlet from bay	84,778 37	
" 5,	"	reservoir, etc., at bay	24,713 78	
" 6,	"	cast iron pipe	123,775 16	
" 6,	"	Wyckoff patent pipe	126,441 31	
" 7,	"	valves, for mains	17,042 25	
" 7,	"	public fire hydrant	15,786 02	
" 8,	"	laying pipe	69,942 44	
" 8,	"	building at the bay	1,299 40	
" 9,	"	water meters	19,116 71	
" 9,	"	furniture and fixtures	887 96	
" 10,	"	implements	1,713 61	
" 10,	"	engineering and superintendence	7,856 17	
" 11,	"	traveling expenses	306 29	
" 11,	"	insurance	29 00	
" 12,	"	interest, discount and commissions	4,224 17	
Folio 15,	Maintenance—	office expenses and salaries	68,804 28	
" 16,	"	repairs and care of hydrants, valves and pipes	21,990 42	
" 17,	"	repairs and care of water meters	7,759 42	
" 18,	"	repairs and care of inlet works	38,521 00	
" 19,	"	repairs to engine house and grounds	4,051 44	
" 20,	"	interest (on bills payable)	3,709 84	
" 21,	"	implements	1,129 37	
" 22,	"	engineers' and firemen's wages	98,930 90	
" 23,	"	fuel	75,415 30	
" 24,	"	oil, packing and supplies	10,210 50	
" 25,	"	repairs to pumping machinery	9,230 84	
" 26,	"	repairs to boiler arches	1,737 29	
" 27,	"	repairs to engine foundations	51 46	
" 28,	"	repairs to dock	13 38	
" 34,	City water works fund		11,235 21	
" 380,	Union Water Meter Co.		3 00	
			$951,719 80	$951,719 80

Account with Water Works Fund.

	Dr.	Cr.
Balance in water works fund January 1st, 1900	$11,897 88	
Cash collections deposited with city treasurer	24,448 06	
By recorder's warrants 371 to 382, inclusive		$25,110 73
By balance in water works fund Dec. 31st, 1900		11,235 21
	$36,345 94	$36,345 94

Account with City Treasurer as Treasurer of Board.

To recorder's warrants No. 371 to 382, inclusive.....	$25,110 73	
By paid orders of secretary of board (Nos. 5,230 to 5,710)	... .	$25,110 7
	$25,110 73	$25,110 73

Bonds and Interest.

The city has paid from moneys, raised by tax levy, the interest on outstanding bonds issued for the construction of water works, and falling due during the year, amounting to $22,390.

Series Nos. 14 and 33 of the original issue of water works bonds, amounting to $20,000.00, and which fell due February 16th, 1900, and March 1st, 1900, respectively, were paid from the proceeds of the sale of refunding bonds Nos. 1 to 20, dated March 1st, 1900, payable March 1st, 1930.

Total amount of bonds paid and retired to date (not refunded,) $100,000.00.

Total amount of bonds refunded, $98,000.00.

Total amount of interest paid to date on water works bonds, $781,145.00.

Total amount of water works bonds outstanding, $352,000; $179,000 bearing interest at the rate of 8 per cent. per annum; $75,000 bearing interest at the rate of 5 per cent. per annum, and $98,000 bearing interest at the rate of 4 per cent. per annum.

$20,000 of the 8 per cent. bonds fall due in 1901, and provision has been made for refunding them.

Bonds Outstanding December 31st, 1900.

Series.	Date of Issue.	Date Payable.	Amount.	Interest.
No. 15	Aug. 15, 1872	Feb. 16, 1901	$ 10.000 00	8 per cent.
No. 16	" 15, 1872	" 16, 1902	10.000 00	8 "
No. 17	" 15, 1872	" 16, 1903	10.000 00	8 "
No. 18	" 15, 1872	" 16, 1904	9.000 00	8 "
No. 19	" 15, 1873	" 16, 1905	10.000 00	8 "
No. 20	" 15, 1873	" 16, 1906	10.000 00	8 "
No. 21	" 15, 1873	" 16, 1907	10.000 00	8 "
No. 22	" 15, 1873	" 16, 1908	10,000 00	8 "
No. 23	" 15, 1873	" 16, 1909	10.000 00	8 "
No. 24	Feb 15, 1874	" 16, 1910	10.000 00	8 "
No. 25	Apr. 15, 1874	Apr. 15, 1911	10.000 00	8 "
No. 26	" 15, 1874	" 15, 1912	10.000 00	8 "
No. 27	" 15, 1874	" 15, 1913	20.000 00	8 "
No. 34	Mar. 1, 1875	Mar. 1, 1901	10.000 00	8 "
No. 35	June 1, 1875	June 1, 1902	10,000 00	8 "
No. 36	" 1, 1875	" 1, 1903	10.000 00	8 "
No 37	" 1, 1875	" 1, 1904	10.000 00	8 "
Not seried—				
No. 1 to 25	May 1, 1891	May 1, 1905	25.000 00	5 "
No. 26 to 50	" 1, 1891	" 1, 1911	25.000 00	5 "
No. 51 to 63	" 1, 1891	" 1, 1917	12,500 00	5 "
No. 64 to 76	" 1, 1891	" 1, 1918	12,500 00	5 "
Refunding—				
No. 1 to 90	Oct. 1, 1895	Oct. 1, 1920	20.000 00	4 "
No. 1 to 20	" 1, 1896	" 1, 1921	20,000 00	4 "
No. 1 to 20	" 15, 1897	" 15, 1927	20.000 00	4 "
No. 1 to 18	" 15, 1898	" 15, 1928	18.000 00	4 "
No. 1 to 20	Mar. 1, 1900	Mar 1, 1930	20.000 00	4 "
			$352.000 00	

Water Rates.

The total amount charged on the roll of 1900 for water was $24,586.17, as follows:

For water supplied at fixed rates	$ 9.948 84
For water supplied through meters	14.637 33

The amount collected on roll of 1900 was $22,801.82.

Collected from fixed rates	$ 9.241 44
Collected from metered water	13.560 38

Amounts uncollected:

From fixed rates	$ 707 40
From metered water	1.076 95

The amount collected during the year from previous year's rolls was $1,314.33, as follows:

From fixed rates	$ 429.93
From metered water	884 40

The total amount collected from all rolls during the year for water was $24,116.15, as follows:

From fixed rates, domestic	$ 9,334 52
From fixed rates, manufacturing	396 85
From metered water, domestic	8,860 39
From metered water, manufacturing	5,524 39

The total amount collected and uncollected on each year's roll since the works commenced supplying water has been as follows:

YEAR.	COLLECTED.	UNCOLLECTED	TOTAL ON ROLL.
1873, January 1st to April 30th	$ 728 82		$ 728 82
1873-4, May 1st, 1873, to April 30th, 1874	5,440 80	$ 1 60	5,442 40
1874-5, May 1st, 1874, to April 30th, 1875	6,908 16	44 85	6,953 01
1875, May 1st to December 31st	7,269 55	28 46	7,298 01
1876	9,571 26	82 73	9 653 99
1877	9,604 26	134 19	9,738 45
1878	10,078 15	324 71	10,402 86
1879	11,708 97	136 07	11,845 04
1880	13,155 74	120 25	13,275 99
1881	15,002 61	212 40	15,215 01
1882	17,352 47	158 85	17,511 32
1883	18,713 46	98 64	18,812 10
1884	18,892 02	129 89	19,021 91
1885	19,716 73	269 58	19,986 31
1886	19,356 61	118 74	19,475 35
1887	19,436 25	87 00	19,523 25
1888	21,278 62	120 80	21,399 42
1889	22,120 47	113 03	22,233 50
1890	23,397 81	202 81	23,500 62
1891	24,624 51	281 35	24,905 86
1892	24,185 81	280 32	24,466 13
1893	23,675 69	484 44	24,160 13
1894	22,836 60	530 66	23,367 26
1895	22,939 51	291 34	23,230 85
1896	23,115 76	326 37	23,442 13
1897	21,995 00	368 19	22,363 19
1898	22,053 85	715 84	22,769 69
1899	22,798 37	691 52	23,489 89
1900	22,801 82	1,784 35	24,586 17
Totals	$500,659 68	$8,138 98	$508,798 66

SOURCE OF SUPPLY.

Of the total of 1,142,339,229 gallons of water supplied to the city, about 30,000,000 gallons, or a little less than 2¾ per cent. was taken from the river. The entire supply has been taken from the bay for 313 days and 37 minutes, and the river has been called upon to help out the supply 41 days and 23 minutes. At no time has the entire supply been taken from the river. The length of time the river has been called upon was about 50 per cent. more than in 1899, but the size of opening necessary to supply the demand has been so much less than during that year, the total quantity of water taken from the river has been less than during the year named.

The dates on which the river valve was open and the length of time it was open, were as follows:

January	1 to 6,	6 days, account sugar factories.
January	7,	18 hours, " " "
January	8,	1 day, " " "
January	9,	18 hours, " " "
January	10,	4 hours, " " "
January	11,	11 hours, " " "
January	12,	15 hours, " " "
January	13,	5 hours, " " "
January	17,	1 hour, on account of fire.
January	19,	8 hours, account of sugar factories.
January	20,	6 hours, " " " "
January	21,	7 hours, " " " "
January	22,	1 day, account of low water.
January	23,	7 hours, account of sugar factories.
January	24,	11 hours, " " " "
January	25,	17 hours, " " " "
January	26 and 27,	2 days, " " " "
January	28,	18 hours, " " " "
January	28,	35 mins., account of fire.
January	29 and 30,	2 days, account of sugar factories.
January	31,	16 hours, " " " "
February	1,	18 hours, " " " "
February	2,	16 hours, " " " "

February	3,	20 hours, account of sugar factories.
February	4,	1 day, " " " "
February	6,	12 hours, " " " "
February	7,	5 hours, " " " "
February	8,	10 hours, " " " "
February	11,	8 hours, " " " "
February	14,	33 mins., account of fire.
February	15,	43 mins., " " "
February	16,	8 hours, account of sugar factories.
February	16,	1 hour, account of fire.
February	17,	6 hours, account of sugar factories.
February	19,	4 hours, " " " "
February	20,	17 mins., account of fire.
February	23,	15 mins., " " "
February	27,	1 hour, 15 mins., account of fire.
March	1,	4 hours, account of demand in city.
March	2,	4 hours, " " " " "
March	5,	7 hours, " " " " "
March	6,	8 hours, " " " " "
March	7,	5 hours, " " " " "
March	7,	17 mins., account of fire.
March	11,	1 hour, " " "
March	15,	30 mins., account of low water.
March	16,	14 mins., account of fire.
March	19,	3 hours, account of demand in city.
April	1,	20 mins., account of fire.
April	10,	25 mins., " " "
July	14,	11 hours, " " "
August	10,	5 hours, account of demand in city.
September	25,	1 hour, account of fire.
October	4,	1 hour 30 mins., account of sugar factories.
October	5,	4 hours, " " " "
October	6,	3 hours, " " " "
October	8,	8 hours, " " " "
October	9,	6 hours, " " " "
October	10,	6 hours, " " " "
October	11,	2 hours, " " " "
October	12,	8 hours 20 mins., " " " "
October	13,	7 hours 30 mins., " " " "
October	15,	3 hours 50 mins., " " " "
October	21,	16 mins., account of fire.
October	24,	35 mins., account of fire.

October 25, 7 hours, account of sugar factories.
October 26, 2 hours, " " " "
October 27, 1 hour 20 mins., account of sugar factories.
October 31, 9 hours 20 mins., " " " "
November 1, 12 hours 30 mins., " " " "
November 1, 1 hour 40 mins., account of fire.
November 3, 20 mins., " " "
November 3, 11 hours 30 mins., account of sugar factories.
November 5, 9 hours, account of low water.
November 6, 1 hour, account of sugar factories.
November 6, 50 mins., account of fire.
November 7, 10 mins., " " "
November 8, 5 hours 30 mins., account sugar factories.
November 11, 1 hour, " " "
November 12, 3 hours 20 minutes, " " "
November 14, 16 hours, " " "
November 14, 42 minutes, account of fire.
November 15, 12 hours, account of sugar factories.
November 16, 14 hours, " " " "
November 16, 18 minutes, account of fire.
November 17, 4 hours, account of sugar factories.
November 17, 1 hour 13 mins., account of fire.
November 21, 9 hours, account of low water.
November 22, 4 hours, account of sugar factories.
November 23, 3 hours, " " " "
November 26, 1 hour 30 mins., account of sugar factories.
November 27, 3 hours 30 mins., " " " "
November 28, 7 hours 30 mins., " " " "
November 29, 6 hours 30 mins., " " " "
November 29, 30 mins., account of fire.
November 30, 4 hours, account of sugar factories.
December 3, 7 hours, " " " "
December 9 and 10, 17 hours, account of anchor ice.
December 17, 10 hours 45 mins., account sugar factories.
December 18, 3 hours, " " " "
December 19, 1 hour, account of fire.
December 20, 4 hours, account of sugar factories.
December 21, 5 hours, " " " "
December 22, 8 hours, " " " "
December 23, 16 hours, account of low water.
December 24, 9 hours, account of sugar factories.
December 26, 14 hours 30 mins., account of sugar factories.

December 27,	19 hours,	account of sugar factories.	
December 28,	4 hours 30 mins.,	" " "	"
December 29,	24 hours,	" " "	"
	41 days, 0 hours, 23 minutes.		

On account of demand of sugar factories,	35 days,	5 hours,	25 mins.
On account of low water in bay,	2 days,	10 hours,	30 mins.
On account of obstruction by anchor ice,		17 hours,	
On account of extra demand in city (no fire)	1 day,	12 hours,	
On account of extra demand for fire service,	1 day,	3 hours,	28 mins.
	41 days,	0 hours,	23 mins.

PUMPING STATION.

The total amount expended for maintenance and operation of pumping plant was as follows:

Salaries of engineers and firemen	$3,620 00
Fuel	3,145 53
Oil, packing and supplies	239 66
Repairs on engines and boilers	376 74
Repairs on boiler arches	10 78
Total	$7,392 71

Total quantity of coal received, 4,602,950 lbs., as follows:

4,265,300 lbs. Wenona Coal & Mining Co. slack @ $1.25		$2,665 80
154,750 lbs. Handy Bros. slack @ $1.36		105 51
40,000 lbs. Michigan Coal Mining Co. slack @ 1.25		25 00
52,000 lbs. Wenona Coal & Mining Co. mine run at $1.25		32 50
90,900 lbs. Michigan Coal Mining Co. lump @ $2.00		90 90
4,602,950		$2,919 71
	Unloading coal from cars	225 82
		$3,145 53
	Average cost per ton delivered in bins	$ 1 37

The quantity of fuel consumed during the year was:

8¼ cords wood, costing	$ 4 25
4,665,950 lbs. coal	3,184 42
	$3,188 67



WATER WORKS PUMPING STATION.

The quantity of fuel at the pumping station January 1st, 1900, was:

14 cords wood, cost	$ 7 00
75,000 lbs. Wenona mine slack	50 62
	$57 62

The quantity of fuel at the pumping station December 31st, 1900, was:

5½ cords wood, cost	$ 2 75
2,000 lbs. slack coal, cost	1 33
10,000 lbs. lump coal, cost	10 40
	$14 48
The cost of oil, packing and supplies delivered at the pumping station during the year was	$ 239 66
The value of supplies on hand at the pumping station January 1, 1900, was	174 68
The value of supplies on hand at the pumping station December 31, 1900, was	145 45
Cost of oil, packing and supplies used during the year	268 89

The net cost of operating the pumping plant was:

For salaries of engineers and firemen	$3,620 00
For fuel consumed	3,188 67
For oil, packing and supplies used	268 89
For repairs to engines and boilers	376 74
Repairs to boiler arches	10 78
	$7,465 08

The total quantity of water pumped during the year was 1,142,339,229 gallons. 12,179,394 gallons were pumped under fire pressure of from 70 lbs. to 80 lbs. per square inch, and 1,130,159,835 gallons were pumped against a domestic pressure of 40 lbs. per square inch. The average head for all the water pumped, including suction lift, was 113 feet.

The Gaskill engines and pumps were run 8734 hours, and pumped 1,127,041,859 gallons.

The quadruplex engines and pumps were run 254 hours and 35 minutes and pumped 14,042,957 gallonr.

The high pressure engine and rotary pumps were run 18 hours and 25 minutes, and pumped 1,254,413 gallons.

The number of alarms for fire, transmitted to the station during the year, was 128, and the time the pumps were run under fire pressure was 61 hours and 42 minutes.

The cost of pumping, based on net cost of maintaining and operating the pumping engines, was $7,465.08.

Per million gallons pumped	$6 53
Per million gallons raised 100 feet	5 73

The cost of fuel was:

Per million gallons pumped	$2 79
Per million gallons raised 100 feet	2 47

The increase in cost of fuel per million gallons pumped over the cost for the last preceding year was due entirely to the quality of the coal used.

Pumping Plant.

BOILERS.

Five in number, all horizontal tubular boilers set in separate brick arches. Three boilers are 16 feet long, 66 inches in diameter, one containing 105 tubes 16 feet long and 2¾ inches in interior diameter, each of the other two containing 64 tubes 16 feet long and 3¾ inches in interior diameter. Two boilers are 16 feet long, 60 inches in diameter, each containing 48 tubes 16 feet long and 3¾ inches in interior diameter.

The area of grate surface under each boiler is: No. 1, 27½ square feet; Nos. 2 and 3, each 24¾ square feet; Nos. 4 and 5, each 22½ square feet. Heating surface: No. 1 (½ shell 138$\frac{34}{100}$ square feet; entire tubes 1,209$\frac{41}{100}$ square feet) 1347$\frac{75}{100}$ square feet; Nos. 2 and 3, each (½ shell 138$\frac{34}{100}$ square feet. entire tubes, 1,005$\frac{31}{100}$ square feet) 1,143$\frac{65}{100}$ square feet; Nos. 4 and 5 each (½ shell 125$\frac{66}{100}$ square feet, entire tubes 753$\frac{98}{100}$ square feet) 879$\frac{64}{100}$ square feet.

ENGINES AND PUMPS.

One Gaskill horizontal compound condensing crank and fly wheel pumping engine, maximum capacity, 5,000,000 gallons in 24 hours.

One Holly quadruplex compound condensing crank and fly wheel pumping engine, maximum capacity, 3,000,000 gallons in 24 hours.

One horizontal high pressure piston engine driving through gears two No. 10 Holly rotary pumps; maximum capacity 2,500,000 gallons in 24 hours.

Capacity of Gaskill pumps per revolution, 119 gallons.

Capacity of quadruplex pumps per revolution, 55 gallons.

Capacity of rotary pumps (2) per revolution, 17 gallons.

The quantity of water pumped each year since the works commenced operations has been as follows:

1873.....	142,477,725 gallons.	1887.....	827,195,000 gallons.
1874.....	294,714,798 "	1888.....	872,990,164 "
1875.....	416,756,579 "	1889.....	944,472,747 "
1876.....	518,197,129 "	1890.....	988,771,453 "
1877.....	538,847,186 "	1891.....	1,014,475,024 "
1878.....	530,197,397 "	1892.....	962,963,662 "
1879.....	672,344,128 "	1893.....	1,044,256,236 "
1880.....	827,067,372 "	1894.....	1,024,735,621 "
1881.....	944,382,043 "	1895.....	1,122,363,460 "
*1882.....	775,642,466 "	1896.....	1,009,523,471 "
1883.....	773,942,702 "	1897.....	944,545,290 "
1884.....	831,867,463 "	1898.....	1,038,794,253 "
1885.....	836,970,016 "	1899.....	1,118,599,631 "
1886.....	779,761,852 "	1900.....	1,142,339,229 "

* Commenced metering.

WATER PUMPED, 1900.

Month.	Gaskill Engines.			Quadruplex Engines.			H. P. Engines and Rotary Pumps.			Gallons Pumped.	Daily Average.	Fires.					
	Hours Run.	Revolutions.	Gallons Pumped.	Hours Run.	Revolutions.	Gallons Pumped.	Hours Run.	Revolutions.	Gallons Pumped.			No. Alarms.	Hours Run.	Highest Pressure.	Lowest Pressure.	Average Pressure.	Gallons Pumped.
January...	742.15	839,044	99,846,236	1.45	3,020	166,100	1.45	7,535	128,095	100,140,431	3,230,336	11	5.41	70	70	70	1,063,622
February.	672.00	839,661	99,919,659	.....	.....	.....	.....	.....	.....	99,919,659	3,568,559	11	5.26	70	70	70	1,190,238
March.....	740.45	901,297	107,254,343	3.15	6,712	369,160	3.15	15,105	256,785	107,880,288	3,480,089	9	3.11	70	70	70	669,970
April.....	715 25	*797,200	83,419,038	124.35	*198,126	5,743,347	2.20	8,971	152,507	89,307,892	2,976,930	13	4.10	70	70	70	705,409
May.....	740.40	*746,000	80,036,722	78.30	*111,674	3,327,087	.....	.....	.....	83,363,809	2,689,155	13	2.59	70	70	70	515,202
June.....	714.35	750,400	89,297,600	5.25	14,055	773,025	3.15	13,522	229,874	90 300,499	3,010,017	10	2.42	70	70	70	474,453
July.....	743.00	763,991	90,914,929	6.40	14,486	796,730	1.00	3,908	66,436	91 778,095	2,960 584	11	14.58	80	60	70	3,453,457
August...	741.45	809.204	96,295,276	2.15	4,725	259,875	2 15	9,356	159,052	96,714 203	3,119,813	7	3.33	70	70	70	621,537
September	720.00	766,483	91,211,477	.....	..	.....	.....	.	.....	91,211,477	3,040,383	11	3.58	80	70	74	753,389
October....	743.40	843,591	100.387,329	.20	1,177	64,735	.....	.....	.....	100,452,064	3.240,389	8	2.21	70	70	70	462,672
November	716.25	*824,484	94,624,278	31.20	44,316	2.437,380	4.35	15,392	261,664	97,323,322	3,244.111	14	7.25	80	70	71	1,367,544
December.	743.30	788,588	93,841,972	.30	* 2,031	105,518	.....	.... .	.....	93 947,490	3,030.564	10	5.18	70	70	70	901,901
Totals...	8,734.00	*9,669.943	1,127,041,859	254.35	*400,322	14,042,957	18.25	73,789	1,254,413	1,142,339,229	3,129,697	128	61.42	80	60	70⅓	12,179,394

*During the months of April, May and November the left Gaskill engine and pump were run 156 hours and 40 minutes with the right hand engine and pump shut down, making 251,161 revolutions, and the right hand Gaskill engine and pump were run 95 hours with the left hand engine and pump shut down, making 146,845 revolutions.

*During the months of April and May the two left hand Quadruplex pumps were run 195 hours with the two right hand pumps disconnected, making 289,766 revolutions.

*During the month of December three of the Quadruplex pumps were run 10 minutes with the left hand pump disconnected, making 480 revolutions.

Greatest quantity of water pumped in one day, 3,993,387 gallons, February 27th.

Least quantity of water pumped in one day, 2,481,150 gallons, May 27th

Daily average for year, 3,129,697 gallons.

MAIN DISTRIBUTION.

The main distribution system has been extended during the year as follows:

In alley between Adams and Jefferson street, from Woodside avenue to First street.

In alley between Madison avenue and Monroe street, from First to Second streets.

In First street, from Water street to alley between Saginaw street and Washington avenue.

In First street, from alley between Monroe and Jackson streets to alley between Jackson and Van Buren streets.

In Van Buren street, from Woodside avenue to Second street.

Across First street, at alley between Washington and Adams streets.

Across First street at Farragut street.

In Third street, from alley between Washington and Adams streets to Adams street.

Across Third street at Adams street.

In alley between Monroe and Jackson streets, from Tenth to Eleventh streets.

Old mains have been replaced by new cast iron pipe as follows:

In Water street, from north of Third street to First street.

In alley between Saginaw street and Washington avenue, from First street to Center avenue.

In alley between Adams and Jefferson streets, crossing Third street.

In alley between Madison avenue and Monroe street, from Second street to Center avenue.

In alley between Monroe and Jackson streets, crossing Third street.

In Grant street, crossing First street.

In Second street, from Water street to alley between Water and Saginaw streets.

In Tenth street, from alley between Jefferson street and Madison avenue to 160 feet east of Grant street.

The total amount expended during the year on account of these extensions and renewals was $9,726.39, as follows:

For cast iron pipe	$5,718 10	
For valves and valve boxes	278 51	
For fire hydrants	198 75	
For laying pipe	3,531 03	
		$9,726 39

The length of the several sizes of pipe laid during the year was as follows:

10-inch cast iron	1,633¼ feet
8-inch cast iron	1,591 "
6-inch cast iron	7,003 "
4-inch cast iron	370 "
	10,597¼ "

The length of pipe taken out or abandoned was:

10-inch cast iron	5½ feet	
8-inch cast iron	44 "	
6-inch cast iron	24 "	
4-inch cast iron	28¼ "	
Total cast iron pipe		101¾ feet
10-inch Wyckoff pipe	11 feet	
8-inch Wyckoff pipe	1,729 "	
6-inch Wyckoff pipe	1,144½ "	
4-inch Wyckoff pipe	3,362¾ "	
Total Wyckoff mains		6,247¼ feet
Total main pipes taken out or abandoned		6,349 feet

Net increase in length of main pipes in distribution system, 4,248¼ feet.

The number of stop valves set in the distribution system during the year was:

10-inch Flower patent	1
8-inch Flower patent	1
6-inch Flower patent	16
4-inch Flower patent	21
Total	39

The number of stop-valves taken out during the year was:

6-inch Flower patent	7
4-inch Flower patent	16
4-inch Galvin patent	1
Total	24

Net increase in number of valves, 15.

The number of fire hydrants set during the year was:

Holly hydrants, 4-inch inlet, 2 hose nozzles	8
Matthews hydrants, 4-inch inlet, 2 hose nozzles	10
Total	18

The number of fire hydrants taken out was:

Holly hydrants, 4-inch inlet, 2 hose nozzles	8
Matthews hydrants, 4-inch inlet, 2 hose nozzles	3
Total	11

Net increase in number of fire hydrants, 7.

The new hydrants set during the year were located as follows:

Southeast corner of Woodside avenue and Van Buren street.

Northeast corner of First and Van Buren streets.

North side of First street, at east side of alley between Adams and Jefferson streets.

South side of Third street, at east side of alley between Madison avenue and Monroe street.

Northwest corner of Tenth and Monroe streets.

North side of Eleventh street, at east side of alley between Monroe and Jackson streets.

Changes have been made in the location of old hydrants as follows:

The hydrant formerly located at the north end of Saginaw street has been moved to the northeast corner of First and Saginaw streets.

The hydrant formerly located at the southwest corner of Second street and Madison avenue has been removed to the northeast corner of the same streets.

The hydrant formerly located at the south side of Third street at alley between Monroe and Jackson street has been removed to the north side of Third street at the same alley.

The hydrant formerly located at the southwest corner of Tenth and Jackson streets has been removed to the northeast corner of the same street.

The hydrant formerly located at the southwest corner of Tenth and Grant streets has been removed to the northwest corner of the same street.

Main Pipe in Service December 31st, 1900.

	CAST IRON.	WYCKOFF.	TOTAL.
20-inch	9,563 ft.		9,563 ft.
16-inch	13,778 ft.		13,778 ft.
12-inch	9,063 ft.		9,063 ft.
10-inch	14,886 ft. 3 in.	27,630 ft.	42,516 ft. 3 in.
8-inch	20,090 ft. 10 in.	16,283 ft. 7 in	36,374 ft. 5 in.
6-inch	27,889 ft. 6 in.	79,655 ft. 6 in.	107,545 ft.
4-inch	3,390 ft.	16,900 ft. 3 in.	20,290 ft. 3 in.
3-inch		319 ft.	319 ft.
Totals	98,680 ft. 7 in.	140,788 ft. 4 in.	239,468 ft. 11 in.

Total cast iron mains ..... 18 miles, 3,640 feet.
Total Wyckoff mains ..... 26 miles, 3,508 feet.
Total mains ..... 45 miles, 1,968 feet.

Percentage of each size:

20 inch ..... 4 per cent.
16 inch ..... 5.75 per cent.
12 inch ..... 3.79 per cent.
10 inch ..... 17.75 per cent.
8 inch ..... 15.19 per cent.
6 inch ..... 44.92 per cent.
4 inch ..... 8.47 per cent.
3 inch ..... .13 per cent.

Valves in Service December 31st, 1900.

	20-in.	16-in.	12-in.	10 in.	8-in.	6-in.	4-in.	3-in.	Total
Flower Patent	4	9	3	39	56	193	336	3	643
Galvin's Patent			2			6	42		50
Eddy Patent						5	6		11
Brown Patent			1			1			2
Totals	4	9	6	39	56	205	384	3	706

Blow-off gates included in above:

Two	6-inch.
Eleven	4-inch.
Two	3-inch.

Fire Hydrants in Service December 31st, 1900.

Matthews, 6-inch inlet, 3 hose nozzles, gated	32
Matthews, 4-inch inlet, 2 hose nozzles	210
Bourbon, 6-inch inlet, 3 hose nozzles, gated	5
Bourbon, 4-inch inlet, 2 hose nozzles	10
Holly, 4-inch inlet, 2 hose nozzles	129
Gaskill, 4-inch inlet, 2 hose nozzles	16
Galvin, 6-inch inlet, 3 hose nozzles, gated	6
Galvin, 4-inch inlet, 2 hose nozzles	4
Morgan, 4-inch inlet, 2 hose nozzles	1
Total	413

WATER METERS.

The amount expended on account of the extension of the meter system during the year was $645.15, as follows:

For 65 new meters purchased	$617 02
For setting meters	28 13
	$645 15

Meters purchased:

12 ⅝ Union Rotary A, cost, with freight	$130 48
6 ⅝ Columbia, cost, with freight	51 19
12 ⅝ Nash, A, cost, with freight	114 96
5 ⅝ Hersey Disc, cost, with freight	47 97
6 ⅝ Thomson Lambert, cost, with freight	56 23
24 ⅝ Trident	216 19
	$617 02

Meters Set in 1900.

	2-in.	1-in.	⅝-in.	½-in	Total
Union Rotary	1	1	1	.....	3
Union Rotary A	.....	.....	8	.....	8
Union Duplex	.....	.....	1	.....	1
Columbia	.....	.....	5	.....	5
Crown	.....	2	.....	.....	2
Empire	.....	.....	.....	2	2
Empire A	.....	.....	1	.....	1
Nash	.....	.....	11	.....	11
Hersey Disc	.....	.....	5	.....	5
Thomson Lambert	...	.....	6	.....	6
Trident	...	.....	23	.....	23
Total	1	3	61	2	67

Meters Taken Out in 1900.

	4-in.	2-in.	1¼-in.	1-in.	⅝-in.	½-in.	Total
Union Rotary	1	1	.....	1	.....	.....	3
Union Rotary A	.....	.....	.....	.....	1	.....	1
Union Duplex	.....	.....	.....	.....	1	.....	1
Crown	.....	.....	.....	2	.....	.....	2
Empire	.....	.....	.....	.....	.....	3	3
Nash	.....	.....	.....	.....	1	.....	1
Worthington	.....	1	1	.....	.....	.....	2
Thomson	.....	.....	.....	.....	1	.....	1
Thomson Bee	.....	.....	.....	.....	.....	1	1
Westinghouse	.....	.....	.....	.....	1	.....	1
Totals	1	2	1	3	5	4	16

Meters in Service December 31st, 1900.

	8-in.	6-in.	4-in.	3-in.	2-in.	1½-in.	1-in.	¾-in.	⅝-in.	½-in.	⅜-in.	Total
Union Rotary	1	1	5	16	5	4	2	1	42			77
Union Rotary A									7			7
Union Duplex									19			19
Columbia									28			28
Crown						1	23	33		28	41	126
Empire							4	32		19		55
Empire A									11			11
Empire AA									39			39
Nash									39			39
Gem					1							1
Worthington					6	3			15			24
Hersey							2	5	26			33
Hersey Disc.									41			41
Thomson							2		101			103
Thomson Bee									18	71		89
Thomson Lambert									30			30
Trident									95			95
Westinghouse									3			3
Pittsburgh Disc									6			6
Total	1	1	5	16	12	8	33	71	520	118	41	826

Meters in Stock December 31st, 1900.

	4-in.	3-in.	2-in.	1½-in	1-in.	¾-in.	⅝-in.	½-in.	⅜-in	Total
Union Rotary	1	5	1		1					8
Union Rotary A							5			5
Union Duplex							3			3
Columbia							1			1
Crown					2	1			1	4
Empire					2	3		6		11
Nash A							4			4
Worthington			1	3			1			5
Thomson						2	1			3
Thomson Bee								1		1
Trident							1			1
Westinghouse							3			3
Total	1	5	2	3	5	6	19	7	1	49

GENERAL MAINTENANCE AND REPAIRS.

Amount expended for maintenance and repairs, not including cost of operating pumping engines, was $7,346.48, as follows:

Salary of superintendent and secretary	$ 1,800 00	
Office assistant	800 00	
Office expenses	293 51	
Repairs on main distribution	784 45	
Repairs and care of services	515 87	
Repairs and care of water meters	841 44	
Service connections	154 97	
Repairs and care of inlet works at bay	1,005 08	
Repairs to engine house	193 34	
Repairs to engine house grounds	20 88	
Repairs to house at bay	846 94	
		$ 7,346 48

The expenses of the office were:

For blank books, printing and stationery	$ 173 30	
For postage stamps and postal cards	104 40	
For repairs to recording gage in office	6 88	
For telephone service, revenue stamps and drafts	9 03	
		$ 293 51

The repairs on main distribution were:

For labor on hydrants, testing and repairing	$ 228 18	
For parts of hydrants from manufacturers	101 12	
For labor on valves and valve boxes	20 75	
For labor repairing 59 leaks in Wyckoff mains	223 86	
For pipe for repairing leaks in Wyckoff mains	79 99	
For labor repairing 3 leaks in cast iron mains	19 87	
For labor raising 12-inch cast iron main for sewer	95 38	
For tools and repairing tools	15 30	
		$ 784 45

The expenditures for repairs and care of services were:

For labor turning on and off water	$ 253 81	
For labor repairing 16 private Wyckoff mains	101 69	
For pipe for repairing private mains	18 61	
For labor and material used in repairing other services	34 76	
For labor changing service connections	6 50	
For examining services and serving notices	100 50	
		$ 515 87

The expenditures for repairs and care of water meters were:

For reading and inspection	$ 294 75	
For labor repairing meters	256 87	
For parts from manufacturers for repairs	55 25	
For repairs on 3 meters sent to factory	26 45	
For labor and material used in repairing meter boxes	68 12	
For labor cleaning and testing meters	90 63	
For labor changing meters	14 75	
For protecting meters from frost	25 00	
For tools and pipe fittings	9 62	
		$ 841 44

The expenditures for service connections were:

For 180 corporation cocks purchased, including freight	$ 112 49	
For valves and branches for large services	10 10	
For rethreading old corporation cocks	2 50	
For repairs on tapping machine	6 38	
For labor inserting taps	23 50	
		$ 154 97

The expenditures for the repairs and care of inlet works at bay were:

For salary of reservoir keeper	$ 420 00	
For rent of telephone	12 00	
For labor on reservoir banks and cut	196 74	
For tools, drayage and cement	11 60	
For stone for retaining wall	476 75	
For labor placing stone	47 99	
		$ 1,095 08

The expenditures for rebuilding house at bay were:

For lumber and material	$ 392 62	
For labor	199 10	
For teaming	26 25	
For plastering and chimneys	77 70	
For painting and papering	120 59	
For eave troughs	22 10	
For well and pump	8 58	
		$ 846 94

The expenditures for repairs to engine house and engine house grounds were:

For repairing conductors, ventilators and roof	$ 158 70	
For repairing coal sheds and boiler room floor	5 75	
For painting engine house	19 60	
For repairing electric light wires	4 79	
For cleaning wells	7 95	
For lawn mower and mowing lawn	15 03	
For grading cinders	2 40	
		$ 214 22

The total cost of maintaining and operating the plant, including the interest on the bonded debt paid by general tax, was $37,129,19; as an offset to this expenditure the department is entitled to credit as follows:

Amount collected for water	$34,116 15	
Amount collected from miscellaneous sources, not on construction	240 10	
		$34,356 25

And for the following described service to the several city departments for which no payment is received:

413 fire hydrants @ $45.00 each	$18,585 00	
12 watering troughs and 4 ornamental fountains	2,400 00	
Flushing sewers	2,000 00	
Sprinkling streets	500 00	
Sprinkling public parks	150 00	
City Hall	200 00	
Six hose houses	150 00	
City electric light plant	300 00	$24,385 00
		$58,741 25

The number of leaks in the main pipes of the distribution system during the year was 62, of which 59 were in the Wyckoff mains and 3 in the cast iron mains.

Of the 59 leaks in Wyckoff mains, 12 were burst pipe. 44 were joint leaks and 3 were knot holes.

The three leaks in cast iron mains were all in lead joints, and were repaired by recaulking the lead.

The 12-inch cast iron main in the alley between Jefferson street and Madison avenue at the crossing of First street was raised about two feet to permit the reconstruction of the sewer on that street before the street was paved. This work was done without shutting off the supply through the pipe.

Three fire hydrants have been broken during the year by runaway teams or the carelessness of the drivers of heavy wagons. One of these hydrants had to be replaced by an entirely new hydrant.

During the months of January, February and March 47 fire hydrants were found frozen, but the frozen hydrants were dis-

covered and the ice removed by employees of this department, and in no instance was the fire department delayed on this account.

The number of leaks in services, repaired by this department without expense to the consumer was 22, of which 16 were in 2-inch Wyckoff private mains, each supplying a number of consumers. Two were in private shut-off valves on large services and four were in lead service pipes.

The whole number of services opened at the curb by employees of this department during the year was 359, and the number shut off was 359.

The services shut off were closed for the following described causes:

For non-payment of rates	60
For leakage	36
For request of consumer	45
For premises vacant	131
For winter months (used in summer only)	87

Service connections put in during the year 1900:

	1"	¾"	⅝"	½"	Total
In cast iron mains	2	9	69	51	131
In Wyckoff mains	....	6	12	22	40
Total	2	15	81	73	171

Service connections taken out or abandoned permanently (main discontinued.)

	1"	¾"	⅝"	½"	Total.
In cast iron mains	2	1	1	....	4
In Wyckoff mains	19	57	31	30	137
Total	21	58	32	30	141

Service connections in main pipes December 31st, 1900.

	Branches.					Corporation Stops.						Total.
	8"	6"	4"	3"	2"	2"	1¼"	1"	¾"	⅝"	½"	⅜"	
In cast iron mains	2	6	14	3	4	2	3	68	119	282	252	5	710
In Wyckoff mains	....	2	13	1	2	....	....	116	298	404	530	6	1372
Total	2	8	27	4	6	2	3	184	417	686	782	11	2082

Abandoned service connections not taken out:

	Branches.	Corporation stops.					Total.
	4"	1"	¾"	⅝"	½"	⅜"	
In cast iron mains	1	8	10	3	12	4	38
In Wyckoff mains	3	10	16	9	19	.....	57
Total	4	18	26	12	31	4	95

Total service connections in use	1,987
Total number of separate service supplied	2,207
Services open December 31st, 1900	1,607
Services shut off	600

The services shut off are closed for the following described reasons:

Buildings or plumbing not completed	14
Premises unoccupied	86
For winter months (used in summer only)	140
Vacant lots	78
Shut at request of consumer	150
Shut for leakage (not repaired)	9
Non-payment of water rates	123
	600

Appended to this report will be found the usual summary of statistics and tables of the uses for which water is supplied.

All of which is respectfully submitted.

E. L. DUNBAR,
Superintendent and Secretary.

SUMMARY OF STATISTICS

For the Year Ending December 31st, 1900.

In form recommended by the New England Water Works Association.

BAY CITY WATER WORKS.

Bay City, Bay County, Mich.

Population by census of 1900, 27,628.
Date of construction, 1S72.
By whom owned, City.
Source of supply, Saginaw Bay.
Mode of supply, pumping.

PUMPING.

1. Builders of pumping machinery, Holly Man'fg. Co.
2. Description of Coal used,
   - *b.* Bituminous.
   - *c.* Size, slack.
   - *d.* Brand, Bay County.
   - *e.* Price per gross ton, delivered, $1.53.
   - *g.* Wood, price, per cord, $1.50.
3. Coal consumed for the year, 4,665,950 lbs.
4. [Pounds of wood consumed] ÷ 3 = equivalent amount of coal, 5,670 lbs.
5. Total fuel consumed for the year = (3) + (4), 4,671,620 lbs.
6. Total pumpage for the year, 1,142,339,229 gallons.
7. Average static head against which pumps work, 93 feet.
8. Average dynamic head against which pumps work, 113 feet.
9. Number of gallons pumped per pound of coal (3), 244.
10. Duty = $\frac{\text{gals. pumped (6) x 8.34 (lbs.) x 100 x dynamic head (8)}}{\text{Total fuel consumed (5)}} = 23,044,756.$

    Cost of pumping, figured on pumping station expenses, viz., $7,465.08.
11. Per million gallons pumped, $6.53.
12. Per million gallons raised one foot (dynamic), $.05 75/100.

    Cost of pumping, figured on total maintenance, viz., ~~$14,739.19~~ 37.129 19
13. Per million gallons pumped, $~~12.90~~ 32 50
14. Per million gallons raised one foot (dynamic), $.~~11+~~ 28 3/4

Financial—Maintenance.

RECEIPTS—DIVISION I.

z.	Balance brought forward,	$	
	From Consumers:		
A.	Water rates, domestic	$18,194 91	
B.	Water rates, manufacturing	5,921 24	
C	Net receipts for water (A) + (B)	$24,116 15	
D.	Miscellaneous (rent, repairs, sales, etc.),	240 10	
E.	Total from consumers		$24,356 25
	From public funds:		
J.	General appropriations	$22,390 00	
	Total		$22,390 00
K.	Gross receipts from all sources		$46,746 25

RECEIPTS - DIVISION II.

	From Fixed Rates:		
L.	Domestic	$ 9,334 52	
M.	Manufacturing	396 85	
N.			$ 9,731 37
	From Meter Rates:		
O.	Domestic	$ 8,860 39	
P.	Manufacturing	5,524 39	
Q.			$14,384 78

EXPENDITURES.

AA.	Management and repairs		$14,739 19
BB.	Interest on bonds		22,390 00
CC.	Total maintenance for year		$37,129 19
DD.	Balance		9,617 06
EE.	Total		$46 746 25

Construction.

RECEIPTS.

R.	From balance of previous year	$11,897 88
	Balance from maintenance	9,017 06
U.	Other sources, material, etc., construction	91 81
V.	Total	$21,006 75

EXPENDITURES.

FF.	Extension of mains	$ 9,726 39
GG.	Extension of meters	645 15
II.	Total construction for year	$10,371 54
JJ.	Balance	11,935 21
KK.	Total	$21,006 75

W. Net cost of works to date, $598,082.21. X. Bonded debt at date, $359,000 00. Z. Rate of interest, 6¼ per cent. average.

CONSUMPTION.

1. Estimated total population at date, 28,000.
2. Estimated population on lines of pipe, 20,000.
3. Estimated population supplied, 16,000.
4. Total consumption for the year, 1,142,339,229 gallons.
5. Passed through domestic meters, 70,440,246 gallons, or 6¼ per cent.
6. Passed through manufacturing meters, 174,634,975 gallons, or 15$\frac{28}{100}$ per cent.
7. Average daily consumption, 3,129,697 gallons.
8. Gallons per day to each inhabitant, 112.
9. Gallons per day to each consumer, 196.
10. Gallons per day to each tap, 1,425.

DISTRIBUTION—MAINS.

1. Kind of pipe, cast iron and Wyckoff.
2. Sizes, from 3-inch to 20 inch.
3. Extended 10,597 feet during year.
4. Discontinued 6,349 feet during year.
5. Total now in use, 45¼ miles.
6. Cost of repairs per mile, $17.32.
7. Number of leaks per mile, 1⅜.
8. Lengths of pipes less than 4 inches diam., 319 feet.
9. Number of hydrants added during year, 7.
10. Number of hydrants now in use, 413.
11. Number of stop gates added during year, 15.
12. Number of stop gates now in use, 706.
13. Number of stop gates smaller than 4-inch, 3.
14. Number of blow-off gates, 15.
15. Range of pressure on mains at center of town, 35 lbs. to 38 lbs.

SERVICES.

16. Kind of pipe, lead, wrought iron, cast iron.
17. Sizes, ⅜-inch to 8-inch.
21. Number of service taps added during year, 42.
22. Number now in use, 2,201.
25. Number of meters added, 51.
26. Number now in use, 826; *a*, Domestic, 731; *b*, Manufacturing, 95.

Uses Supplied at Fixed Rates January 1st, 1901.

Automatic Sprinklers	3	Hotels	11
Boarding Houses	4	Halls (public)	7
Butcher Shops	7	Harness Shops	2
Bakery	1	Hose for Sprinkling	217
Barber Shops	9	Knitting Factory	1
Blacksmith Shops	3	Meat Ware House	1
Bicycle Repair Shop	1	Meat Markets	2
Bottling Works	5	Offices	24
Bath Room (public)	2	Plumber Shops	2
Bath Room (Turkish)	1	Photo Gallery	5
Boat Dock	1	Printing Office	3
Business Blocks	14	Plating Works	1
Banks	2	Pawn Shop	2
Brass Foundry	1	Passenger Depot	1
Boilers (power)	3	Restaurants	7
Billiard Room	1	Stores	64
Baths (private)	130	Saloons	40
Coal Yard	1	Schools	15
Chicory Factory	1	Stone Yard	1
Clothes Cleaning	2	Stables (mill)	4
Carriage Shops	3	Stables (hotel)	1
Churches	4	Stables (livery)	4
Cigar Factory	1	Stables (private)	69
Dwellings	555	Telegraph Office	1
Dye Works	1	Telephone Exchange	1
Express Office	1	Tin Shop	1
Fire Pipes	2	Tailor Shop	1
Fish Market	1	Undertakers' Rooms	2
Gas Works	1	Water Motors	2
Green Houses	2	Ware Houses	2
Gas Engines	2	Water Closets and Urinals	590

Uses Supplied Through Meters January 1, 1901.

Armory	1	Hotels	12
Automatic Sprinklers	2	Hose for Sprinkling	527
Ashery	1	Ice House	1
Bakeries	4	Kindling Factories	2
Banks	3	Laundries	5
Bath Room (public)	1	Locomotive Round House	1
Baths (private)	470	Locomotive Stand Pipe	1
Bicycle Factory	1	Mattrass Factory	1
Boarding Houses	8	Machine Shops	6
Boiler Shops	5	Meat Markets	2
Bottling Works	4	Masonic Temple	1
Box Factories	3	Offices	29
Brewery	1	Opera House	1
Business Blocks	29	Planing Mills	11
Business College	1	Passenger Depot	2
Butcher Shops	5	Photograph Gallery	1
Barber Shops	2	Plumber Shop	1
Boilers (power)	50	Pipe Factory	1
Blacksmith Shop	1	Plow Factory	1
Creamery Package Factory	1	Printing Offices	6
Carpenter Shop	1	Paint Shop	1
Carpet Cleaning	1	Restaurants	2
Churches	6	Railroad Coach Yard	1
Club Rooms	2	Stores	69
Coal and Wood Yards	2	Saloons	13
County Jail	1	Sausage Factory	1
County Court House	1	Seed House	1
Cracker Factory	1	Saw Mills	7
Cross Arm Factory	1	Salt Blocks	4
Crystal Water Works	1	Sash and Door Factories	2
Canning Works	1	Schools	3
Chemical Works	1	Stable (bus and hack)	1
Dwellings	615	Stable (hotel)	1
Drill House	1	Stables (mill)	2
Drainage Pump	1	Stables (livery)	6
Electric Light Works	1	Stable (street car)	1
Elevator Tanks	5	Stables (private)	110
Freight Depot	1	Stave and Heading Factory	1
Fire Pipes	20	Shade Roller Factory	1
Flouring Mills	2	Telephone Exchange	1
Foundries	4	Telegraph Office	1
Government Building	1	Water Closets and Urinals	1345
Gas Engines	4	Water Motors	79
Green Houses	4	Woodenware Works	1
Halls (public)	12	Ware House	1
Hospitals	2		

City Uses for Which no Payment is Made.

1 City Hall.
6 Steamer, Truck and Hose Houses, 20 Horses, 2 Steamers and 1 Chemical
1 Electric Light Station, 3 Boilers.
30 Water Closets and Urinals in City Buildings.
6 Baths in City Buildings.
12 Public Watering Troughs.
4 Ornamental Fountains.
10 Lawn Hose for Sprinkling Parks.
2 Street Sprinkler Carts.
413 Public Fire Hydrants.

Uses Shut Off January 1, 1901.

Ashery	1	Mattrass Factory	1
Boarding Houses	4	Mortar Yard	1
Blacksmith Shops	5	Offices	8
Block	1	Plumbing Shop	1
Barber Shop	3	Planing Mill	1
Broom Factory	1	Pasture	1
Box Factory	1	Round Hoop Factory	1
Baths (private)	30	Stave and Heading factory	1
Cemeteries	6	Skating Rink	1
Churches	2	Stables (private)	27
Creamery	1	Saloons	7
Dwellings	235	Saw Mill	1
Drill House	1	Salt Block	1
Dry Kiln	1	Stores	59
Fire Pipe	4	Stone Yard	1
Fish Market	1	Stable (livery)	1
Fair Grounds	1	Tin Shop	1
Flour Mill	1	Vacant Lots	70
Hotels	10	Water Closets and Urinals	83
Hose for Sprinkling	172	Water Motors	3
Harness Shop	1	Ware Houses	3
Market Garden	1	Wood Yard	1
Machine Shop	1		



WATER DEPARTMENT

THIRTIETH ANNUAL REPORT



DECEMBER 31ST

1904

BAY CITY, MICH.





THIRTIETH

ANNUAL REPORT

—OF THE—

WATER DEPARTMENT

—OF—

BAY CITY, MICHIGAN

December 31st, 1901

BAY CITY, MICH.
PRESS OF C. & J. GREGORY CO.
1902

Water Department.

1902.

COMMISSIONERS.

G. HENRY SHEARER, PRESIDENT
(Term Expires Sept. 6th, 1902.)

BENJAMIN F. RAY.
(Term Expires Sept. 6th, 1903.)

ROBERT E. BOUSFIELD.
(Term Expires Sept. 6th, 1904.)

HOMER E. BUCK.
(Term Expires Sept. 6th, 1905.)

WALTER S. COUSINS.
(Term Expires Sept. 6th, 1906.)

ARTHUR H. INGRAHAM.
(Term Expires Sept. 6th, 1907.)

ARTHUR F. BROOKMAN.
(Term Expires Sept. 6th, 1908.)

DEPARTMENT OFFICERS AND EMPLOYEES.

E. L. DUNBAR ..... Supt. and Secy.
T. A. DELZELL ..... Office Assistant.
FRANK H. COLLINS ..... Inspector.
THOMAS LARDNER ..... Turnkey.
LEVI D. CARPENTER ..... Reservoir Keeper.
A. B. VERITY ..... First Engineer.
JAS. E. DARLING ..... Second Engineer.
JAS. H. MCGIBBONS ..... Fireman.
FRANK O'HARE ..... Fireman.



WATER WORKS PUMPING STATION.

Superintendent's Report.

To the Honorable the Board of Water Commissioners of Bay City, Michigan:

GENTLEMEN: I beg leave to submit the thirtieth annual report of the Water Department of this city, showing the operations of the department for the year ending December 31st, 1901.

The total quantity of water pumped during the year was 1,082,691,511 gallons, which is about 60 million gallons less than the quantity pumped during the year 1900. More than 30 million gallons of this reduction was in the quantity of water supplied through meters for manufacturing purposes, the quantity supplied to the North American Chemical Company being nearly 40 million gallons less than in 1900.

The only serious break in connection with the works during the year occurred on the 23rd of August. The Bay City Sugar Company were driving piles for a railroad track on their premises, and, through a misapprehension on the part of the person in charge of the work as to the location of the intake pipe where it crosses their premises, three piles were driven directly through the pipe before it was discovered that they were endangering the city supply. The pipe being in a bed of quick-sand at this point, it was but a short time before the settlement of the ground at the surface, and the condition of the supply at the pumping station, gave notice of something wrong; the trouble was quickly located and the supply from the bay promptly shut off, to avoid, as far as possible, filling the pipe with sand; and the entire supply for the city was taken from the river until September 14th, when the break was repaired and the water again turned in from the bay. The length of pipe removed and replaced by new pipe was 33½ feet. The entire expense of repairing this break was $546.91, which amount was afterward refunded to this department by the Bay City Sugar Company.

Aside from the use of river water rendered necessary by the break in the intake pipe above mentioned, the river supply has been used 52 hours and 53 minutes; the sugar factories have so reduced their demands upon the supply through the intake pipe that it has been necessary to open the river supply but twice, on their account, during the present operating season of the factories, and then for only a short time.

The removal of the power station of the Consolidated Railway Company, from the west side of the river to its present location on Water street in this city, caused your superintendent to apprehend serious results to the cast iron mains in the distribution system, from electrolytic action, due to the return currents of said railway company. Tests made within the past few weeks indicate the presence of electric currents of dangerous voltage on the main pipes in portions of the city, and a thorough electrical survey of the cast iron mains is recommended; the survey to be made by an expert electrician; the condition of the pipes to be thoroughly investigated at such points as the examination may determine to be most exposed. At the December (1900) meeting of the board, your attention was called to this matter, and a resolution was drafted and presented to the honorable common council, calling attention to the conditions and notifying the Consolidated Railway Company that it would be held responsible for any damage which might be incurred by this department, from said mentioned cause; this resolution was adopted by the common council and a proper notice served on the railway company by the city recorder.

In view of the serious conditions which exist in several cities from the cause mentioned, and the numerous large suits for damages now pending in the courts, and the probability of similar conditions in our own city, it would seem to be advisable for the city to expend a few hundred dollars in the effort to determine the extent of the injury (if any) which the water mains are suffering, without waiting for an actual break, which might occur at a critical moment, and endanger the supply of the entire city.

The liability of the present intake from the bay to such accidents as occurred last summer, and herein before mentioned, and the fact that the regular demands upon the works during some portions of the year so nearly approach the full limit of the capacity of the present pipe, appeal strongly for the early construction of a new intake of suitable capacity, and so located as to be free from liability to such accidents. The west shore of the bay is the most suitable for securing a water supply, but should it be determined to continue the source of supply at its present location, the new intake should be located in the lines of the public highways, as far as practicable, and, when it becomes necessary to pass across private property, the complete surface rights should be acquired, and the line secured from surface encroachment of every nature.



FINANCIAL.

Receipts.

The total receipts of the department for the year 1901 were $25,650,25, from the following accounts:

From water rates, roll of 1891	$ 13 82	
From water rates, roll of 1892	3 40	
From water rates, roll of 1894	7 50	
From water rates, roll of 1897	8 62	
From water rates, roll of 1898	30 00	
From water rates, roll of 1899	103 40	
From water rates, roll of 1900	1,271 74	
From water rates, roll of 1901	22,627 26	
Total from water rates		$24,065 74
From service connections	218 00	
From plumbers' licenses	40 00	
From repairs to water meters	5 00	
From repairs to inlet pipe from bay	546 91	
Total miscellaneous—Maintenance		809 91
From Wyckoff pipe sold	565 50	
From cast iron pipe sold	91 25	
From laying pipe account	117 85	
Total miscellaneous—Construction		774 60
Total receipts		$25,650 25

The receipts by months were:

January	$1,269 18	
February	633 65	
March	1,336 62	
April	1,815 54	
May	1,004 16	
June	1,640 82	
July	1,868 78	
August	791 30	
September	1,273 78	
October	3,305 20	
November	1,029 71	
December	9,681 51	
		$25,650 25

Expenditures.

The expenditures of the department during the year were $23,006.79, for the following accounts:

MAINTENANCE ACCOUNTS.

Office department:		
Salaries	$2,600 00	
Office expenses	237 70	
Street and service department:		
Repairs on main distribution	781 89	
Repairs and care of services	455 96	
Repairs and care of water meters	831 56	
Service connections	77 11	
Inlet department:		
Repairs and care of inlet works at bay	484 90	
Repairs to inlet pipe from bay	554 12	
Repairs and care of river inlet	22 01	
Pumping department:		
Salaries	3,670 68	
Fuel	3,022 91	
Oil, packing and supplies	229 41	
Repairs on engines and boilers	480 00	
Repairs to boiler arches	95 23	
Repairs to buildings and grounds:		
Repairs to engine house	118 49	
Repairs to engine house grounds	37 75	
Total for maintenance and operating expenses		$13,699 72

CONSTRUCTION ACCOUNTS.

Water meters:		
New meters	627 84	
Setting meters	12 98	
Main distribution:		
Cast iron pipe	4,456 18	
Valves	127 44	
Fire Hydrants	197 45	
Laying pipe	3,885 18	
Total for construction accounts		9,307 07
Total expenditures		$23,006 79

The expenditures, by months, were:

January	$1,341 86
February	1,051 87
March	1,200 23
April	1,309 46
May	1,116 83

June	1,283 17	
July	3,248 81	
August	3,067 87	
September	4,398 00	
October	2,148 77	
November	1,213 48	
December	1,626 44	
		$23,006 79

Ledger Balance for 1901.

Ledger F.		Dr.	Cr.
Folio 115,	Water rates, roll of 1901		$22,627 26
" 117,	Water rates, roll of 1900		1,271 74
" 118,	Water rates, roll of 1899		103 40
" 118,	Water rates, roll of 1898		30 00
" 118,	Water rates, roll of 1897		8 62
" 119,	Water rates, roll of 1894		7 50
" 119,	Water rates, roll of 1892		3 40
" 119,	Water rates, roll of 1891		13 82
" 120,	Plumbers' licenses		40 00
" 127,	Service connections		140 89
" 141,	Wyckoff pipe		565 50
" 224,	Union Water Meter Co		3 00
" 121,	City water works fund	$ 2,643 46	
" 122,	Office department salaries	2,600 00	
" 123,	Office department expenses	237 70	
" 136,	Street and service dept., rep'rs on main dis't	781 89	
" 141,	Street and service dept., repairs and care of services	455 96	
" 136,	Street and service dept., repairs and care of water meters	826 56	
" 128,	Inlet dept., repairs to inlet from river	22 01	
" 128,	Inlet dept., repairs to inlet pipe from bay	7 21	
" 129,	Inlet dept., repairs and care of inlet works at bay	484 90	
" 130,	Pumping dept., salaries	3,670 68	
" 131,	Pumping dept., fuel	3,022 91	
" 132,	Pumping dept., oil, packing and supplies.	229 41	
" 133,	Pumping dept., repairs to engines and boilers	480 00	
" 134,	Pumping dept., repairs to boiler arches	95 23	
" 135,	Repairs to engine house	118 49	
" 135,	Repairs and care of engine house grounds.	37 75	
" 137,	Water meter account, new meters	630 84	
" 137,	Water meter account, setting meters	12 98	
" 138,	Main distribution, cast iron pipe	4,364 93	
" 138,	Main distribution, valves	127 44	
" 138,	Main distribution, fire hydrants	197 45	
" 139,	Main distribution, laying pipe	3,767 33	
		$24,815 13	$24,815 13

Balance Sheet—Bay City Water Works.

Ledger F.	DECEMBER 31ST, 1901.	Dr.	Cr.
Folio 1,	Bay City bond account		$443,045 87
" 1,	Water assessment, frontage on pipe		736 07
" 28,	Service connections, etc		3,831 54
" 29,	Plumbers' licenses		1,000 20
" 30,	Rents, dockage, etc		2,627 33
" 32,	Water rates		524,725 42

Folio	2,	Construction—real estate		$ 6,724 83	
"	2,	"	dock, tramway and store shed	1,882 63	
"	3,	"	engine house, chimney and wells	21,401 42	
"	3,	"	engine foundations, boiler foundations and arches	6,777 45	
"	4,	"	pumping machinery	59,427 72	
"	4,	"	inlet from river	4,799 46	
"	5,		inlet from bay	84,778 37	
"	5,	"	reservoir, etc., at bay	24,713 78	
"	6,	"	cast iron pipe	128,140 09	
"	6,	"	Wyckoff patent pipe	12b,875 81	
"	7,	"	valves for mains	17,169 69	
"	7,	"	public fire hydrants	15,983 47	
"	8,	"	laying pipe	73,709 77	
"	8,	"	buildings at bay	1,299 40	
"	9,	"	water meters	19,760 53	
"	9,		furniture and fixtures	887 96	
"	10,	"	implements	1,713 61	
"	10,	"	engineering and superintendence	7,856 17	
"	11,	"	travelling expenses	306 29	
"	11,	"	insurance	29 00	
"	12,	"	interest, discount and commissions	4,224 17	
"	15,	Maintenance—office, expense and salaries		71,641 98	
"	16,	"	repairs, and care of hydrants, vales and pipes	23,228 27	
"	17,	"	repairs and care of water meters,	8,585 98	
"	18,	"	repairs and care of inlet works and. pipe	39,035 12	
"	19,	"	repairs to engine house and grounds	4,207 68	
"	20,	"	repairs to dock	13 38	
"	20,	"	interest (on bills payable)	3,709 84	
"	21,	"	implements	1,129 37	
"	22,	"	engineers' and firemen's wages	102,601 58	
"	23,	"	fuel	78,438 21	
"	24,	"	oil, packing and supplies	10,439 91	
"	25,	"	repairs to pumping mach'y	9,710 84	
"	26,	"	repairs to boiler arches	1,832 52	
"	27,	"	repairs to engine foundations	51 46	
"	34,	City water works fund		13,878 67	
				$975,966 43	$975,966 43

Bonds and Interest.

Refunding bonds Nos. 1 to 20, for the sum of $1,000 each, were issued, bearing date March 1st, 1901, payable March 1st, 1931, with interest at 4 per cent. per annum, payable annually. The proceeds of the sale of these bonds were used to retire Series Nos. 15 and 34 of the original issue of water works bonds, which were issued August 15th, 1872, and

March 1st, 1875, and were due February 16th, and March 1st, 1901. respectively.

The total amount of water works bonds now outstanding is $352,000.00; of which, $159,000.00 bear interest at 8 per cent. per annum, $75,000.00 bear interest at 5 per cent. per annum, and $118,000.00 bear interest at 4 per cent. per annum.

Amount of bonds paid and retired to date (not refunded) $100,000.00.

Amount of bonds refunded, $118,000.00

The amount of interest on water works bonds accruing during the year was $21,590.00, all of which was paid by moneys raised by tax levy. The total amount of interest paid on water works bonds to date is $802,735 00.

Bonds Outstanding December 31st, 1901.

Series.	Date of Issue.	Date Payable.	Amount.	Interest.
No. 16	Aug. 15, 1872...	Feb. 16, 1902...	$ 10.000 00	8 %
No. 17	" 15, 1872...	" 16, 1903...	10.000 00	8 %
No. 18	" 15, 1872..	" 16, 1904...	9.000 00	8 %
No. 19	" 15, 1873...	" 16, 1905...	10.000 00	8 %
No. 20	" 15, 1873...	" 16, 1906...	10.000 00	8 %
No. 21	" 15, 1873...	" 16, 1907...	10.000 00	8 %
No. 22	" 15, 1873...	" 16, 1908...	10.000 00	8 %
No. 23	" 15, 1873...	" 16, 1909...	10.000 00	8 %
No. 24	Feb. 15, 1874...	" 16, 1910...	10,000 00	8 %
No. 25	Apr. 15, 1874...	Apr. 15, 1911...	10,000 00	8 %
No. 26	" 15, 1874...	" 15, 1912...	10,000 00	8 %
No. 27	" 15, 1874...	" 15, 1913...	20.000 00	8 %
No. 35	June 1, 1875...	June 1, 1902...	10,000 00	8 %
No. 36	" 1, 1875...	" 1, 1903...	10.000 00	8 %
No. 37	" 1, 1875..	" 1, 1904.	10.000 00	8 %
Not seried—				
No 1 to 25	May 1, 1891...	May 1, 1905...	25.000 00	5 %
No. 26 to 50	" 1, 1891...	" 1, 1911...	25.000 00	5 %
No. 51 to 63	" 1, 1891...	" 1, 1917...	12.500 00	5 %
No. 64 to 76	" 1, 1891...	" 1, 1918...	12.500 00	5 %
Refunding—				
No. 1 to 20	Oct. 1, 1895...	Oct. 1, 1920...	20.000 00	4 %
No. 1 to 20	" 1, 1896...	" 1, 1921 ..	20.000 00	4 %
No. 1 to 20.	" 15. 1897...	" 15, 1927...	20.000 00	4 %
No. 1 to 18	" 15, 1898...	" 15, 1928..	18.000 00	4 %
No. 1 to 20	Mar. 1, 1900...	" 1, 1930...	20.000 00	4 %
No. 1 to 20	" 1, 1901...	" 1, 1931...	20,000 00	4 %
			$ 352.000 00	

Account with Water Works Fund.

	Dr.	Cr.
Balance in water works fund January 1, 1901	$11,235 21	
Cash collections deposited with city treasurer..	25,650 25	
By recorder's warrants Nos. 383 to 394, inclusive	.....	$23,006 79
By balance in water works fund, Dec. 31, 1901	.....	13,878 67
	$36,885 46	$36.885 46

Account with City Treasurer as Treasurer of Board.

	Dr.	Cr.
To recorder's warrants Nos. 383 to 394, inclusive	$23,006 79	
By paid secretary's orders Nos. 5,711 to 6,158, inclusive		$23,006 79
	$23,006 79	$23,006 79

Water Rates.

The total amount charged on the roll of 1901 for water was $24,653.78, as follows:

For water supplied at fixed rates	$ 9,878 73
For water supplied through meters	14,775 05
	$24,653 78

The amount collected on roll of 1901 was:

From fixed rates	$ 9,123 14
From metered rates	13,504 12
	$22,627 26

Amounts uncollected on roll of 1901:

From fixed rates	$ 755 59
From metered water	1,270 93
	$ 2,026 52

The amount collected during the year from previous years was $1,438.48, as follows:

From fixed rates	$ 516 29
From metered water	922 19
	$ 1,438 48

The total amount collected from all rolls during the year was:

From fixed rates, domestic	$ 9,004 38
From fixed rates, manufacturing	635 05
From metered water, domestic	9,370 19
From metered water, manufacturing	5,056 12
	$24,065 74

Total amount collected and uncollected on each year's Roll since the works commenced supplying water:

YEAR.	Collected.	Uncollected.	Total on Roll.
1873 January 1st to April 30th	$ 728 82	$	$ 728 82
1873-4, May 1st, 1873, to April 30th, 1874	5,440 80	1 60	5,442 40
1874-5, May 1st, 1874, to April 30th, 1875	6,908 16	44 85	6,953 01
1875, May 1st to December 31st	7,969 55	28 46	7,298 01
1876	9,571 26	82 73	9,653 99
1877	9,604 26	134 19	9,738 45
1878	10,078 15	324 71	10,402 86
1879	11,708 97	136 07	11,845 04
1880	13,155 74	120 25	13,275 99
1881	15,002 61	212 40	15,215 01
1882	17,352 47	158 85	17,511 32
1883	18,713 46	98 64	18,813 10
1884	18,892 02	129 89	19,021 91
1885	19,716 73	269 58	19,986 31
1886	19,356 61	118 74	19,475 35
1887	19,436 25	87 00	19,523 25
1888	21,278 69	120 80	21,399 42
1889	22,120 47	113 03	22,233 50
1890	23,297 81	202 81	23,500 62
1891	24,638 33	267 53	24,905 86
1892	24,189 21	276 32	24,465 53
1893	23,675 69	484 44	24,160 13
1894	22,844 10	523 16	23,367 26
1895	22,939 51	291 34	23,230 85
1896	23,115 76	326 37	23,442 13
1897	22,008 62	359 57	22,368 19
1898	22,083 85	685 84	22,769 69
1899	22,901 77	588 12	23,489 89
1900	24,073 56	612 61	24,686 17
1901	22,627 26	2,026 52	24,653 78
Totals	$ 524,725 42	$ 8,826 42	$ 533,551 84

SOURCE OF SUPPLY.

From August 23rd to September 14th, while the break in the intake pipe was being repaired, the entire supply was taken from the river; the total quantity of water pumped during this time was 63,500,000 gallons. Aside from this, the river valve has been partially open about 53 hours, supplying about 3,500,000 gallons, making total quantity of water supplied from the river 67,000,000 gallons, or a trifle more than 6 per cent. The balance of the supply has been taken from the bay.

The dates on which the river valve was open were as follows:

January 5, 45 minutes, on account of fire.
January 5, 1 hour 30 minutes, on account of sugar factories.
January 7, 3 hours, on account of sugar factories.
January 8, 2 hours 30 minutes, on account of fire.

January	8,	2	hours, on account of sugar factories.
January	9,	20	minutes, on account of fire.
January	13,	1	hour, on account of fire.
January	16,	15	minutes, on account of fire.
February	2,	1	hour 30 minutes, on account of fire.
February	27,	2	hours, on account of fire.
March	6,	3	hours 5 minutes, on account of fire.
April	10,	6	hours, on account of fire.
July	20,	1	hour 20 minutes, on account of fire.
August	23	to	
September	14,	22	days 30 minutes, on account of break in intake pipe.
November	1,	1	hour 15 minutes, on account of fire.
December	2,	30	minutes, on accoount of fire.
December	3 and 4,	12	hours 30 minutes, on account of anchor ice.
December	5,	30	minutes, on account of excessive demand.
December	17,	25	minutes, on account of fire.
December	18,	4	hours, on account of excessive demand.
December	18,	1	hour, on account of fire.
December	19,	6	hours on account of sugar factories.
December	21,	1	hour 28 minutes on account of fire.

Total—24 days, 5 hours, 23 minutes.

On account of break,	22 days,	30 mins.
On acount of supply to sugar factories,	12 hours,	30 mins.
On account of obstruction by anchor ice	12 hours,	30 mins.
On account of excessive demand in city, not fire,	4 hours,	30 mins.
On account of excessive demand for fire service	23 hours	23 mins.
Total	24 days, 5 hours,	23 mins.

PUMPING STATION.

The total quantity of water pumped during the year, without any allowance for slip in pumps, was 1,082,691,511 gallons, of which 13,703,294 gallons were pumped against a fire pressure of from 70 to 80 pounds per square inch, and 1,068,988,217 gallons were pumped against a domestic pressure of 40 pounds per square inch, at the pressure gauge. Average head against which all water was pumped, including suction lift, 113 feet.

The Gaskill engines and pumps were run 8,326 hours and 10 minutes, pumping 1,070,168,725 gallons.

The quadruplex engines and pumps were run 141 hours, pumping 10,824,605 gallons.



WATER WORKS PUMPING STATION

The high pressure engine and rotary pumps were run 21 hours and 35 minutes, pumping 1,698,181 gallons.

The total amount expended during the year for operating the pumping engines was $7,498.23, as follows:

For engineers' and firemen's wages	$3,670 68
For fuel	3,022 91
For oil, packing and engineers' supplies	229 41
For repairs to pumping machinery (engines and boilers)	480 00
For repairs to boiler arches	95 23
	$7,498 23

The net cost of operating the pumping engines was $7,478.65, as follows:

For engineers' and firemen's wages	$3,670 68
For fuel consumed	2,957 39
For oil, packing and engineers' supplies used	275 35
For repairs to engines and boilers	480 00
For repairs to boiler arches	95 23
	$7,478 65

The quantity of fuel at the pumping station January 1, 1901, was:

5½ cords wood, cost	$ 2 75
2,000 lbs. slack coal, cost	1 33
10,000 lbs. lump coal, cost	10 40
	$ 14 48

The quantity of fuel delivered at the pumping station during the year was:

32,000 lbs.	Wolverine lump, cost	$ 48 00
45,400 lbs.	Pittsburg nut, cost	36 32
35,000 lbs.	Wolverine slack, cost	22 75
45,000 lbs.	Pittsburg slack, cost	24 75
42,800 lbs.	Central Coal Co. slack, cost	29 96
72,000 lbs.	Handy Bros. slack, cost	48 60
212,400 lbs.	Michigan mine slack, cost	143 37
3,679,600 lbs.	Wenona mine slack, cost	2,115 74
596,700 lbs.	Wenona mine lump, cost	343 10
	Unloading from cars, cost	210 32
4,760,900		$3,022 91

The quantity of fuel at the pumping station December 31, 1901, was:

128,000 lbs.	Wenona mine lump, cost	$ 80 00

Fuel consumed during the year:

5½ cords wood, cost		$ 2 75
4,644,900 lbs.	coal, cost	2,954 64
		$2,957 39

Average cost of coal per ton in bins, $1.27.

The value of oil, packing and engineers' supplies at the pumping station, January 1, 1901, was	$ 145 45
Cost of oil, packing and supplies delivered at the pumping station during the year	$ 229 41
Value of oil, packing and supplies on hand December 31, 1901	$ 99 51
Oil, packing and supplies used during the year 1901	$ 275 35

The cost of pumping, based on net cost of operating pumping engines ($7,478.65), was:

Per million gallons pumped	$ 6 91
Per million gallons raised 100 feet	6 11

The cost of fuel consumed ($2,957.39) was:

Per million gallons pumped	$ 2 73
Per million gallons raised 100 feet	2 42

Pumping Plant.

BOILERS.

One boiler, horizontal tubular (installed in 1872), 16 feet long, 66 inches in diameter, containing 105 tubes, 16 feet long and 2¾ inches interior diameter.

Two boilers, horizontal tubular (installed in 1893), 16 feet long, 60 inches in diameter, each containing 48 tubes, 16 feet long and 3¾ inches interior diameter.

One boiler, horizontal tubular (installed in 1898), 16 feet long, 66 inches in diameter, containing 64 tubes, 16 feet long and 3¾ inches interior diameter.

One boiler, horizontal tubular (installed in 1899), 16 feet long, 66 inches in diameter, containing 64 tubes, 16 feet long and 3¾ inches interior diameter.

The area of grate surface under each boiler is: No. 1, 27½ square feet; Nos. 4 and 5, each, 22½ square feet; Nos. 2 and 3, each, 24¾ square feet. Heating surface: No. 1 (½ shell $138\frac{84}{100}$ square feet, entire tubes $1,209\frac{51}{100}$ square feet), $1,347\frac{75}{100}$ square feet; Nos. 4 and 5, each (½ shell $125\frac{66}{100}$ square feet, entire tubes $753\frac{98}{100}$ square feet), $879\frac{64}{100}$ square feet; Nos. 2 and 3, each (½ shell $138\frac{84}{100}$ square feet, entire tubes $1,005\frac{31}{100}$ square feet), $1,143\frac{85}{100}$ square feet.

ENGINES AND PUMPS.

One "Gaskill" horizontal compound condensing crank and fly wheel pumping engine, maximum capacity, 5,000,000 gallons in 24 hours.

One "Holly" quadruplex compound condensing crank and fly wheel pumping engine, maximum capacity, 3,000,000 gallons in 24 hours.

One horizontal, high pressure piston engine, driving through gears, two No. 10 "Holly" rotary pumps, maximum capacity, 2,500,000 gallons in 24 hours.

Capacity of Gaskill pumps, per revolution, 119 gallons.

Capacity of quadruplex pumps, per revolution, 55 gallons.

Capacity of rotary pumps, per revolution, 17 gallons.

The quantity of water pumped each year since the works commenced supplying water, has been as follows:

1873	142,477,725 gallons.	1887	827,195,000 "
1874	294,714,798 "	1888	872,990,164 "
1875	416,756,579 "	1889	944,472,747 "
1876	518,197,129 "	1890	988,771,453 "
1877	538,847,186 "	1891	1,014,475,024 "
1878	530,197,397 "	1892	962,953,662 "
1879	672,344,128 "	1893	1,044,256,286 "
1880	827,067,372 "	1894	1,024,735,621 "
1881	944,382,043 "	1895	1,122,363,460 "
*1882	775,642,466 "	1896	1,009,523,471 "
1883	773,942,702 "	1897	944,545,290 "
1884	831,867,463 "	1898	1,038,794,253 "
1885	836,970,016 "	1899	1,118,599,631 "
1886	779,761,852 "	1900	1,142,339,229 "
		1901	1,082,691,511 gallons.

* Commenced metering.

WATER PUMPED, 1901.

Month.	Gaskill Engines.			Quadruplex Engines.			H. P. Engines and Rotary Pumps.			Gallons Pumped.	Daily Average.	Fires.					
	Hours Run.	Revolutions.	Gallons Pumped.	Hours Run.	Revolutions.	Gallons Pumped.	Hours Run.	Revolutions.	Gallons Pumped.			No. Alarms.	Hours Run.	Highest Pressure.	Lowest Pressure.	Average Pressure.	Gallons Pumped.
January....	744	751,259	89,399,821	1.15	3,050	167,750	.....	.....	.....	89,567,571	2,889,276	22	12.44	80	70	73	2,417,307
February....	669.05	737,822	87,800,818	3.15	8,190	450,450	1.40	7,132	121,244	88,372,512	3,156,161	12	7.44	70	70	70	1,096,205
March.....	743.20	855,468	101,800,692	2.05	*4.292	177,045	40	4,022	68,374	102,046,111	3,291,810	16	10.43	80	70	72	1,931,875
April..	705.25	*770,958	82,617,594	118.30	141,446	7,944,530	13.20	60,559	1,029,503	91,591,627	3,053,054	15	10.34	75	70	73	1,916,693
May.....	736.50	*728,552	81,364,941	7.10	15,962	877,910	.....	.....	.....	82,242 851	2,652,995	6	1.58	70	70	70	295,715
June.....	718.45	760,359	90,482,721	1.15	2,866	157,630	.....	.....	....	90,640,351	3,021,345	12	6.44	70	70	70	1,154,776
July.	742.55	781,770	93,030,630	1.20	3,304	181,720	1.25	6,768	115,056	93,327,406	3,010,561	11	4.15	80	70	74	888,406
August.. ...	743	762,093	90,687,877	1	2,487	136,785	1	4,829	82,093	90,906,755	2,932,476	9	4.04	70	70	70	670,445
September..	718.30	729,106	86,763,614	1.30	3,723	204,765	1.30	7,091	120,547	87,088,926	2,902,964	11	4.41	70	70	70	817,292
October.....	743	768,078	91,401,382	1	2,075	114,125	1	4,782	81,294	91,596,701	2,954,732	9	3.11	70	70	70	552,398
November...	720	701.154	83,437,326	.....	.....	.....	.....	.....	.....	83,437,326	2,781,244	15	4.30	70	70	70	744,940
December...	741.20	767,911	91,381,409	2.40	7,4 9	411,895	1	4,710	80,070	91,873,374	2,963,657	17	7.11	70	70	70	1,287,342
Totals...	8,726.10	9,114.520	1,070,168.725	141	197,884	10,824,605	21 35	99,803	1,698,181	1,082,691.511	2,966.278	155	78.19	80	70	71½	13,703,294

*During the month of March, three of the Quadruplex Pumps were run 2 hours and 5 minutes with the fourth pump disconnected, making 4,292 revolutions.

*During the months of April and May, the left Gaskill Engine and Pump were run 104 hours, with the right hand engine and pump shut down, making 153,385 revolutions; and the right Gaskill Engine and Pump were run 52 hours and 30 minutes, with the left hand engine and pump shut down, making 89,626 revolutions.

Greatest quantity of water pumped in one day, 3,762,915 gallons; March 6th.
Least quantity of water pumped in one day, 2,414,084 gallons; May 15th.
Daily average for year, 2,966,278 gallons.

MAIN DISTRIBUTION.

The total amount expended during the year, on account of extensions and renewals on the main distribution system was $8,666.25, as follows:

For cast iron pipe	$4,456 18
For valves and valve boxes	127 44
For fire hydrants	197 45
For laying pipe	3,885 18
	$8,666 25

The distribution system has been extended as follows:

In Adams street from Third street to Fourth avenue.

In Fourth avenue from Adams street to alley between Washington avenue and Adams street.

In Fourth avenue from Van Buren street to Grant street.

Across Fourth avenue at Farragut street.

Across Fourth avenue at Sheridan street.

Across Fourth avenue at Birney street.

Across Fourth avenue at Hampton street.

In alley between Monroe and Jackson street from Eleventh street to Columbus avenue.

Old mains have been replaced by new cast iron pipe as follows:

In alley between Saginaw street and Washington avenue, from First street to 209 feet north of First street.

In alley between Washington avenue and Adams street, from Second to Third streets.

In alley between Washington avenue and Adams street, from Fourth avenue to Center avenue.

In alley between Adams and Jefferson streets, crossing Fourth avenue.

In alley between Jackson and Van Buren streets, crossing Fourth avenue.

In alley between Monroe and Jackson streets, from Second street to Third street.

In alley between Monroe and Jackson streets, from Third street to Center avenue.

In Van Buren street, crossing Fourth avenue.

In Van Buren street, from Center avenue to 52½ feet south of Columbus avenue.

In Grant street, from Center avenue to 40 feet north of Fourth avenue.

In Sherman street, crossing Fourth avenue.

In Lincoln avenue, crossing Fourth avenue.

In Lincoln avenue, from Center avenue to Sixth street.

In Columbus avenue, from main in Van Buren street, east 22 feet.

Fire hydrants have been set in the following described locations:

Southwest corner of Third and Adams streets.

South side of Fifth avenue at alley between Saginaw street and Washington avenue.

Northeast corner of Grant street and Fourth avenue.

North side of Columbus avenue at alley between Monroe and Jackson streets.

Changes have been made in the location of hydrants, as follows:

The hydrant, before located on the north side of Fourth avenue at the alley between Washington avenue and Adams street, has been removed to the northwest corner of Adams street and Fourth avenue.

The hydrant, before located on the southwest corner of Fourth and Washington avenues, has been removed to the south side of Fourth avenue at the alley between Saginaw street and Washington avenue.

The hydrant, before located on the south side of Fifth avenue at the alley between Washington avenue and Adams street, has been removed, and a new hydrant placed on the north side of Fifth avenue, at the same alley.

The hydrant, before located on the south side of Fifth avenue at the alley between Monroe and Jackson streets, has been removed to the north side of Fifth avenue, at the same alley.

The hydrant, before located on the south side of Fourth avenue at the alley between Monroe and Jackson street, has been removed to the north side of Fourth avenue, at the same alley.

All other hydrants, taken out on account of renewal of main pipes, have been reset in the same location as before.

The Morgan hydrant located at the northwest corner of Broadway and La Fayette avenue has been removed, and a Matthews hydrant set in its place.

The Galvin hydrant located at the northwest corner of Naboabish avenue and Trumbull street has been removed, and a Matthews hydrant set in its place.

The length of the several sizes of pipe laid during the year was as follows:

10-inch cast iron	3,069½ feet	
8-inch cast iron	110½ feet	
6-inch cast iron	4,805 feet	
4-inch cast iron	750¾ feet	
		8,735¾ feet

The length of pipe taken out or abandoned was:

10-inch cast iron	25 feet		
8-inch cast iron	4⅞ feet		
6-inch cast iron	34½ feet		
4-inch cast iron	140 feet		
Total cast iron		204 2-12 ft.	
10-inch Wyckoff	3,047 feet		
8-inch Wyckoff	106 feet		
6-inch Wyckoff	4,482¾ feet		
4-inch Wyckoff	162 10-12 ft		
Total Wyckoff		7,798 7-12 ft.	
Total pipe taken out or abandoned			8,002¾ feet
Net increase in length of pipe			733 feet

The number of valves set in the distribution system during the year was:

10-inch Flower valves	2
6-inch Flower valves	2
4-inch Flower valves	26
Total valves set	30

The number of valves taken out was:

10-inch Flower valves	2
6-inch Flower valves	2
4-inch Flower valves	21
3-inch Flower valves	2
Total valves taken out	27
Net increase in number of valves	3

The number of fire hydrants set was:

Holly hydrants	3
Matthews hydrants	22
Total hydrants set	25

The number of fire hydrants taken out was:

Holly hydrants	2
Matthews hydrants	17
Morgan hydrant	1
Galvin hydrant	1
Total hydrants taken out	21
Net increase in number of fire hydrants	4

Main Pipe in Service December 31, 1901.

Size.	Cast Iron.	Wyckoff.	Total.
20 inch	9,563 ft.		9,563 ft.
16 inch	13,778 ft.		13,778 ft.
12 inch	9,083 ft.		9,083 ft.
10 inch	17,930 ft. 9 in.	24,583 ft.	42,513 ft. 9 in.
8 inch	20,196 ft. 8 in.	16,177 ft. 7 in.	36,374 ft. 3 in.
6 inch	32,660 ft.	75,172 ft. 9 in.	107,832 ft. 9 in.
4 inch	4,000 ft. 9 in.	16,737 ft. 5 in	20,738 ft. 2 in.
3 inch		319 ft.	319 ft.
Totals	107,212 ft. 2 in.	132,989 ft 9 in.	240,201 ft. 11 in.

Total cast iron mains	20 miles, 1,612 feet.
Total Wyckoff mains	25 miles, 989 feet.
Total mains	45 miles, 2,601 feet.

Percentage of each size:

20 inch	3.98 per cent.
16 inch	5.74 per cent.
12 inch	3.78 per cent.
10 inch	17.70 per cent.
8 inch	15.14 per cent.
6 inch	44.89 per cent.
4-inch	8.64 per cent.
3 inch	.13 per cent.

Valves in Service December 31, 1901.

	20 in.	16 in.	12 in.	10 in.	8 in.	6 in.	4 in	3 in.	Total.
Flower Patent	4	9	3	39	56	193	341	1	646
Galvin Patent	.....	.....	2	.....	.....	6	42	.....	50
Eddy Patent	.....	.....	.....	.....	.....	5	6	.....	11
Brown	.....	.....	1	.....	.....	1	.....	.....	2
Totals	4	9	6	39	56	205	389	1	709

Blow off gates included in above:

Two ..... 6-inch.
Eleven ..... 4-inch.

Fire Hydrants in Service December 31st, 1901.

Matthews, 6-inch inlet, 3 hose nozzles, gated	32
Matthews, 4-inch inlet, 2 hose nozzles	215
Bourbon, 6-inch inlet, 3 hose nozzles, gated	5
Bourbon, 4-inch inlet, 2 hose nozzles	10
Holly, 4-inch inlet, 2 hose nozzles	130
Gaskill, 4-inch inlet, 2 hose nozzles	16
Galvin, 6-inch inlet, 3 hose nozzles, gated	6
Galvin, 4-inch inlet, 2 hose nozzles	3
Total	417

WATER METERS.

The amount expended during the year on account of the extension of the meter system was $640.82:

61 new meters purchased at a cost of	$627 84
And the amount expended on account of setting meters	12 98
	$640 82

The number of meters set was 77, of which 9 were to replace meters taken out. The number of meters taken out and not replaced was 13, making net increase in number of meters in service 55. Whole number of meters in service, December 31, 1901, 881.

Meters purchased in 1901:

1 1½ inch Union Rotary A.
18 ⅝ inch Union Rotary A.
12 ⅝ inch Nash A.
30 ⅝ inch Trident.

Meters Taken Out in 1901.

	4-in.	3-in.	1½-in.	1-in.	¾-in.	⅝-in.	½-in.	⅜-in.	Total.
Union Rotary ..	2	2	.....	.....	.....	1	.....	.....	5
Union Rotary A	.....	.....	.....	.....	.....	1	.....	.....	1
Crown	.....	.....	1	3	1	.....	1	2	8
Empire.....	.....	.....	.....	2	1	.....	1	.....	4
Thomson.....	.....	.....	.....	.....	....	2	.....	.....	2
Thomson Bee...	.....	... ...	.....	.....	.....	1	1	.....	2
Totals.... ..	2	2	1	5	2	5	3	2	22

Meters Set in 1901.

	4-in.	3-in.	2-in.	1½-in.	1-in.	¾-in.	⅝-in.	½-in.	Total.
Union Rotary ..	1	1	1	....	1	.....	.....	.....	4
Union Rotary A	.....	.....	.....	1	....	.....	24	.....	25
Columbia.....	.....	.....	.....	....	....	.....	1	.....	1
Crown	.....	.....	.... ..	.....	.....	1	.....	....	1
Empire	.....	.... ..	.....	.....	1	.....	.....	....	1
Nash.....	... .	.....	.....	.....	.....	.....	16	.....	16
Thomson.....	.....	.....	.....	.....	.....	2	1	.....	3
Thomson Bee...	.....	.....	.....	.....	.....	.....	.....	1	1
Trident	....	.... ..	.... ..	....	.....	.....	25	.....	25
Totals.....	1	1	1	1	2	3	67	1	77

Meters in Service December 31, 1901.

	8-in.	6-in.	4-in.	3-in.	2-in.	1½-in.	1-in.	¾-in.	⅝-in.	½-in.	⅜-in.	Total.
Union Rotary	1	1	4	15	6	4	3	1	41	....	....	76
Union Rotary A	....	....	....	....	....	1	....	....	30	....	....	31
Union Duplex	....	....	....	....	....	....	....	....	19	....	....	19
Columbia	....	....	....	....	....	....	....	....	29	....	....	29
Crown	....	....	....	....	....	....	20	33	....	27	39	119
Empire	....	....	....	....	....	....	3	31	....	18	....	52
Empire A	....	....	....	....	....	....	....	....	11	....	....	11
Empire AA	....	....	....	....	....	....	....	....	39	....	....	39
Nash	....	....	....	....	....	....	....	....	55	....	....	55
Gem	....	....	....	....	1	....	....	....	....	....	....	1
Worthington	....	....	....	....	6	3	....	....	15	....	....	24
Hersey	....	....	....	....	....	....	2	5	26	....	....	33
Hersey Disc	....	....	....	....	....	....	....	....	41	....	....	41
Thomson	....	....	....	....	....	....	2	2	100	....	....	104
Thomson Bee	....	....	....	....	....	....	....	....	17	71	....	88
Thomson Lambert	....	....	....	....	....	....	....	....	30	....	....	30
Trident	....	....	....	....	....	....	....	....	120	....	....	120
Westinghouse	....	....	....	....	....	....	....	....	3	....	....	3
Pittsburg Disc	....	....	....	....	....	....	....	....	6	....	....	6
Totals	1	1	4	15	13	8	30	72	582	116	39	881

Meters in Stock, December 31, 1901.

	4-in.	3-in.	2-in.	1½-in.	1-in.	¾-in.	⅝-in.	½-in.	⅜-in.	Total.
Union Rotary	2	6	....	....	....	....	....	....	....	8
Union Rotary A	....	....	....	....	....	....	1	....	....	1
Union Duplex	....	....	....	....	....	....	3	....	....	3
Crown	....	....	....	1	5	1	....	1	3	11
Empire	....	....	....	....	3	4	....	7	....	14
Worthington	....	....	1	3	....	....	1	....	....	5
Thomson	....	....	....	....	....	....	2	....	....	2
Thomson Bee	....	....	....	....	....	....	1	1	....	2
Trident	....	....	....	....	....	....	6	....	....	6
Westinghouse	....	....	....	....	....	....	3	....	....	3
Totals	2	6	1	4	8	5	17	9	3	55

Total cost of meter system to date:

Cost of 881 meters in service	$16,728 27
Cost of 55 meters in stock	1,952 05
Cost of meter fittings in stock	76 10
Amount expended in setting 125 meters (out)	970 76
Amount expended in setting 3 motor indicators (out)	33 35
Total	$19,760 53

GENERAL MAINTENANCE AND REPAIRS.

The number of leaks in the main pipes of the distribution system during the year was 59—57 in Wyckoff mains and 2 in cast iron mains. 15 leaks in Wyckoff mains were burst pipe, 39 were joint leaks, and 3 were knot holes. The 2 leaks in cast iron mains were in lead joints.

The 10-inch Wyckoff pipe on Belinda street was raised to make way for a sewer.

The fire hydrants have been carefully examined twice during the year; 44 have been repaired, and 2 have been replaced entirely by new hydrants. During the months of February and March, 24 hydrants were found frozen by employes of this department and at once placed in working order. The fire department has in no case been delayed in its work by frozen hydrants.

The number of service pipes repaired by this department, without expense to the consumer, was 16—12 in 2-inch Wyckoff private mains, and 4 in lead services. Of the 12 leaks in Wyckoff private pipes, 6 were burst pipe, 5 joint leaks and 1 knot hole. The leaks in lead services, repaired by this department, were caused by employes of this, or some other, department of the city government, and were not a proper charge against the consumer.

The whole number of services shut off during the year, by employes of this department, was 331, and the number opened was 367. Of the services shut off, 21 were closed for non-payment of rates, 23 for leakage, 124 premises vacant, 84 at request of consumer, and 79 for winter months, used in summer only.

The total amount expended for general maintenance and repairs, not including the cost of operating the pumping engines and interest, was $6,201,49, for the following accounts: Office department:

Salaries	$2,600 00	
Office expenses	237 70	
		$2,837 70

Street and service department:

Repairs on main distribution	$ 781 89	
Repairs and care of services	455 96	
Repairs and care of water meters	831 56	
Service connections	77 11	
		$2,146 52

Inlet department:

Repairs and care of inlet works at bay	$ 484 90	
Repairs to inlet pipe from bay	554 12	
Repairs to river inlet	22 01	
		1,061 03

Repairs to buildings and grounds:

Repairs to engine house	$ 118 49	
Repairs and care of engine house grounds	37 75	
		156 24
		$6,201 49

The expenditures for the office were:

Superintendent and secretary's salary	$1,800 00	
Office assistant	800 00	
Postage stamps and postal cards	99 40	
Blank books	36 20	
Printing, binding and stationery	36 65	
Printing report for 1900	50 00	
Dials for office guage	4 45	
Telegraph, telephone, stamps, drafts, etc	11.00	
		$2,837 70

The repairs on main distribution were:

Labor repairing leaks in Wyckoff mains	$ 238 87	
Pipe used in repairing leaks in Wyckoff mains	90 27	
Labor repairing leaks in cast iron mains	4 75	
Labor repairing hydrants and valves	158 96	
Shop repairs and parts from manufacturers	78 31	
Painting hydrants, labor and material	39 35	
Examining and testing hydrants	111 12	
Raising pipe and moving hydrants	17 87	
Valve boxes	37 20	
Tools and repairing tools	5 19	
		$ 781 89

The expenditures for repairs and care of services were:

Labor turning on and off water	$ 210 78	
Examining services and notifying consumers	160 10	
Labor repairing leaks in Wyckoff private mains	56 13	
Pipe used in repairing Wyckoff private mains	12 37	
Repairing lead services and service connections	16 58	
		$ 455 96

For repairs and care of water meters:

Reading meters and inspection	$ 304 00	
Labor repairing meters	269 00	
Parts from manufacturers for repairs	43 24	

Labor, cleaning and testing	62 75	
Labor, taking out and changing	37 81	
Protecting meters from frost	20 61	
Labor and material repairing boxes	77 69	
Repairing connections	7 23	
Tools and repairing tools	9 23	
		$ 831 55

For service connections:

72 corporation cocks, and freight	$ 38 98	
Rethreading old taps	3 00	
Labor inserting taps	32 88	
Tools	2 25	
		$ 77 11

For repairs and care of inlet works at bay:

Salary of reservoir keeper	$ 420 00	
Telephone service	12 00	
Labor on reservoir banks and cut	42 00	
Cement	2 40	
Wire screen	6 60	
Tools	1 90	
		$ 484 90

For repairing inlet pipe from bay:

Labor	$ 262 73	
Piles and driving piles	42 00	
Lumber	75 53	
Pumping and setting up pump	65 91	
Pipe, sleeve and clamps	105 76	
Tools	2 19	
		$ 554 12

For repairs to river inlet:

Labor repairing inlet crib	$ 7 50	
Lumber and spikes	14 51	
		$ 22 01

For repairs to engine house:

Brick floor in fire room	$ 71 70	
Repairing ventilators	9 83	
Repairs on coal shutes	3 00	
Door in east wall of engine room	12 24	
Repairs on windows	5 84	
Floor in pits	10 35	
Cleaning sewer, etc	5 53	
		$ 118 45

For repairs to engine house grounds:

Mowing lawn	$ 14 25	
Painting fence around wells	15 25	
Cleaning up and grading	8 25	
		$ 37 75

SERVICE CONNECTIONS.

Service connections put in during the year 1901:

	Branches.	Corporation Stops.				Total.
	4″	1″	¾″	⅝″	½″	
In Cast Iron Mains	3	10	8	73	53	147
In Wyckoff Mains		2	9	14	16	41
Totals	3	12	17	87	69	188

Service connections taken out or abandoned permanently (mains discontinued):

	Branches.		Corporation Stops.				Total.
	6″	4″	1″	¾″	⅝″	½″	
In Wyckoff Mains	1	3	23	39	45	47	158

Total service connections in main pipes, December 31, 1901:

	Branches.					Corporation Stops.							Total.
	8″	6″	4″	3″	2″	2″	1¼″	1″	¾″	⅝″	½″	⅜″	
In Cast Iron Mains	2	6	17	3	4	2	3	78	127	305	305	5	857
In Wyckoff Mains	....	1	10	1	2	...	..	95	268	373	499	6	1255
Totals	2	7	27	4	6	2	3	173	395	678	804	11	2112

Abandoned service connections, not taken out:

	Branches.			Corporation Stops.					Total.
	6″	4″	2″	1″	¾″	⅝″	½″	⅜″	
In Cast Iron Mains	1	1	.....	8	12	3	12	4	41
In Wyckoff Mains	.....	3	1	10	14	8	15	.....	51
Totals	1	4	1	18	26	11	27	4	92

Total service connections in use 2,020
Total number of separate services supplied 2,256
Number of services open, Dec. 31, 1901 1,713
Number of services shut off, Dec. 31, 1901 543

The services shut off have been closed for the following described reasons:

Building or plumbing not completed	7
Premises unoccupied	55
Vacant lots	74
Closed for winter months (used in summer only)	120
Closed at request of consumers	157
Non-payment of rates	130
	543

The total cost of maintaining and operating the plant, including interest on bonded debt paid by tax levy, was $35,289.72.

As an offset to this expenditure, the department is entitled to credit, as follows:

Amount collected for water	$24,055 74
Collected from miscellaneous sources, not on construction accounts	809 91

Water supplied for public uses, for which no payment is made:

417 public fire-hydrants @ $45 each	$18,765 00
13 watering troughs	1,950 00
12 drinking fountains	300 00
4 ornamental fountains	200 00
City Hall	200 00
City electric light plant	200 00
6 hose houses	150 00
Sprinkling streets	500 00
Sprinkling public parks	150 00
Flushing sewers	2,000 00
	$49,290 65

All of which is respectfully submitted.

E. L. DUNBAR,
Superintendent and Secretary.

SUMMARY OF STATISTICS

For the Year Ending December 31, 1901.

BAY CITY WATER WORKS.

Bay City, Bay County, Mich.

Population by census of 1900, 27,628.
Date of construction, 1872.
By whom owned, city.
Source of supply, Saginaw Bay.
Mode of supply, pumping.

PUMPING.

1. Builders of pumping machinery, Holly Man'fg. Co.
2. Description of coal used,
   - *b.* Bituminous.
   - *c.* Slack.
   - *d.* Bay County.
   - *e.* Per gross ton, $1.42.
   - *g.* Wood, price per cord, $1.50
3. Coal consumed for year, 4,644,900 lbs.
4. Pounds of wood consumed, 3 3,667 lbs. coal.
5. Total fuel consumed for year, 4,648,567 lbs.
6. Total pumpage for year, 1,082,691,511 gallons.
8. Average dynamic head against which pumps work, 113 feet.
9. Number of gallons pumped per pounds of coal, 233.
10. Duty, $= \frac{1,082,691,511 \times 8^{34} \times 100 \times 113}{4,648,567} =$ 21,949,353

Cost of pumping, figured on pumping station expenses, viz., $7,478.65.

11. Per million gallons pumped, $6.91.
12. Per million gallons raised one foot (dynamic), .06 1/100

Cost of pumping, figured on total maintenance, viz., $35,289.72.

13. Per million gallons pumped, $32.59.
14. Per million gallons raised one foot (dynamic), .28 4/100

Financial—Maintenance.

RECEIPTS—DIVISION I.

A.	Water rates, domestic	$18,374 57	
B.	Water rates, manf'g	5,691 17	
C.	Net receipts for water		$24,065 74
D.	Rent, repairs, licenses, etc	809 91	
E.	Total from consumers		$24,875 65
	From public funds:		
J.	For interest on bonds (from tax levy)	21,590 00	
K.	Gross receipts from all sources		$46,465 65

RECEIPTS—DIVISION II.

	From fixed rates:		
L.	Domestic	$ 9,004 38	
M.	Manufacturing	635 05	
N.	Total from fixed rates		$ 9,639 43
	From meter rates:		
O.	Domestic	$ 9,370 19	
P.	Manufacturing	5,056 12	
Q.	Total from meter rates		$14,426 31

EXPENDITURES—MAINTENANCE.

AA.	Manage't and rep'rs	$13,699 72	
BB.	Interest on bonds	21,590 00	
CC.	Total maintenance for year		$35,289 72
DD.	Balance	11,175 93	
EE.	Total		$46,465 65

Construction.

RECEIPTS.

R.	Balance from previous years	$11,235 21	
	Balance from maintenance	11,175 93	
U.	Material, etc., sold, construction	774 60	
V.	Total		$23,185 74

EXPENDITURES.

FF.	Extension of mains	$ 8,666 25	
GG.	Water meters	640 82	
II.	Total construction for year		$ 9,307 07
JJ.	Balance	13,878 67	
KK.	Total		$23,185 74

W. Net cost of works to date $607,461.62
X. Bonded debt at date 352,000.00
Y. average rate of interest. 6 per cent.

CONSUMPTION.

1. Estimated total population to date, 28,000.
2. Estimated population on pipe lines, 20,000.
3. Estimated population supplied, 16,000.
4. Total consumption for year, 1,082,691,511 gallons.
5. Passed through domestic meters, 71,179,347 gallons, or 6$\frac{57}{100}$ per cent.
6. Passed through manufacturing meters, 142,889,886 gallons, or 13$\frac{2}{10}$ per cent.
7. Average daily consumption, 2,966,278 gallons.
8. Gallons per day to each inhabitant, 106.
9. Gallons per day to each consumer, 185.
10. Gallons per day to each service, 1,315.

DISTRIBUTION—MAINS.

1. Kind of pipe, cast iron and Wyckoff patent.
2. Sizes, from 3-inch to 20-inch.
3. Extended during year, 8,736 feet.
4. Discontinued during year, 8,003 feet.
5. Total now in use, 45½ miles.
6. Cost of repairs per mile, $17.18.
7. Number of leaks per mile, 1 $\frac{3}{10}$
8. Length of pipe, less than 4-inch diameter, 319 feet.
9. Number of hydrants added, 4.
10. Number of hydrants now in use, 417.
11. Number of stop gates added, 3.
12. Number of stop gates now in use, 709.
13. Number of stop gates, less than 4-inch, 1.
14. Number of blow off gates, 13.
15. Range of pressure on mains at center of town, day and night, 35 to 38 lbs.

SERVICES.

16. Kind of pipe, lead, wrought iron and cast iron.
17. Sizes, ⅜-inch to 8-inch.
21. Number of services added during the year, 55.
22. Number of services now in use, 2,256.
25. Number of meters added, 55.
26. Number of meters now in use, 881.

a. domestic, 784; b. manufacturing, 97.

Uses Supplied at Fixed Rates January 1st, 1902.

Automatic Sprinklers	3	Harness Shops	2
Bakeries	2	Hose for Sprinkling	199
Banks	2	Hospital	1
Barber Shops	8	Hotels	10
Bath Room (public)	1	Knitting Factory	1
Bath Room (Turkish)	1	Meat Markets	5
Baths (private)	139	Meat Warehouses	2
Billiard Room	1	Motor Pumps	1
Blacksmith Shops	6	Offices	14
Boarding Houses	4	Paint Shop	1
Boilers (power)	4	Passenger Depots	2
Bottling Works	5	Pawn Shops	2
Brass Foundry	1	Photograph Galleries	4
Business Blocks	13	Plumber Shops	3
Butcher Shops	3	Printing Offices	2
Carriage Shops	3	Restaurants	8
Chicory Factory	1	Saloons	42
Churches	2	Schools	14
Cigar Factories	2	Stables (mill)	3
Clothes Cleaning	2	Stables (private)	70
Coal Yard	1	Stables (livery)	5
Dairy	1	Stables (hotel)	2
Dwellings	601	Stone Yard	1
Dye Works	1	Stores	65
Express Office	1	Tailor Shops	2
Fire Pipes	3	Telegraph Office	1
Fish Market	1	Telephone Exchange	1
Gas Engines	2	Tin Shop	1
Gas Works	1	Undertakers' Rooms	2
Green Houses	2	Warehouses	2
Halls (public)	6	Water Closets and Urinals	647

Uses Supplied Though Meters, January 1st, 1902.

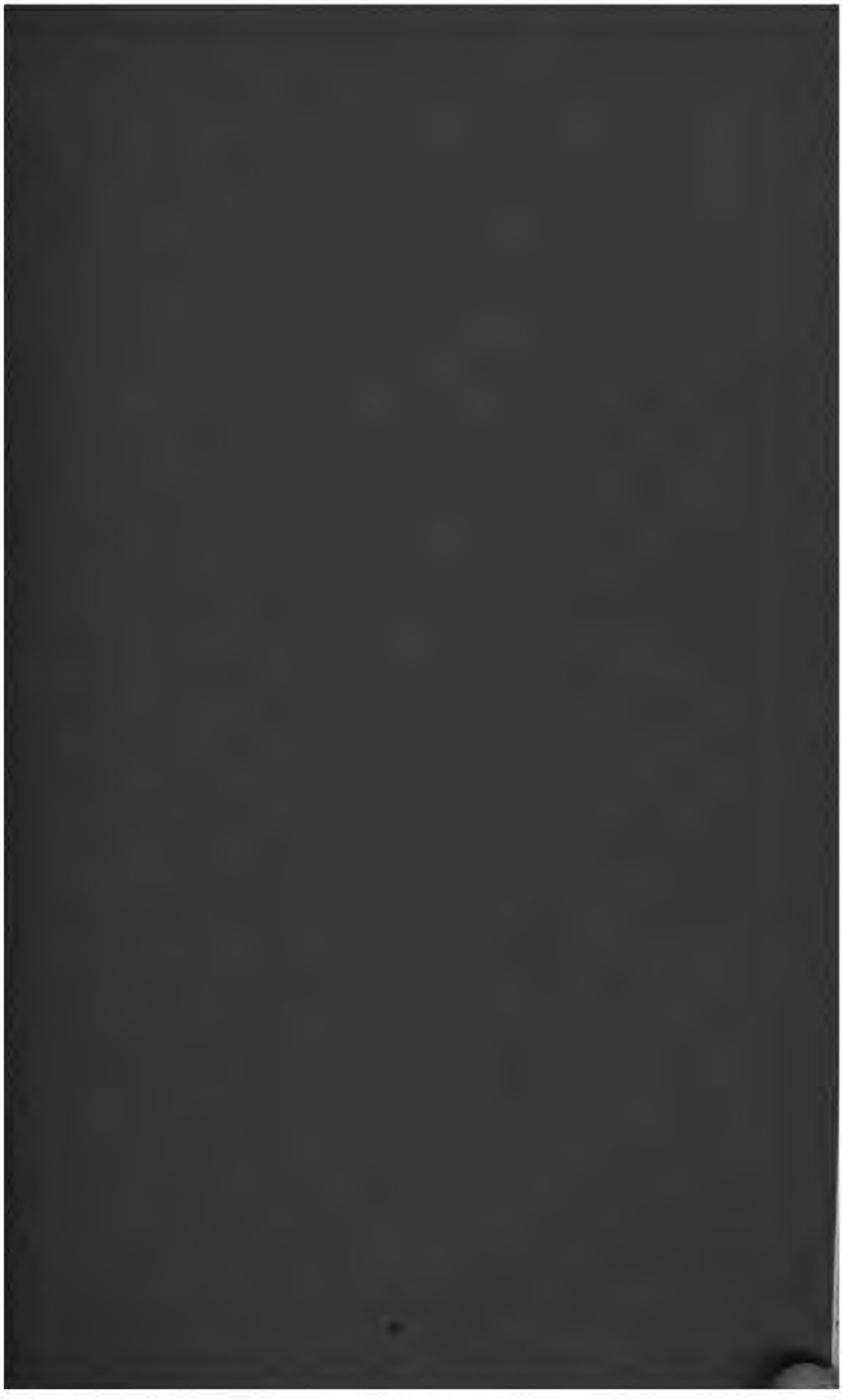
Asheries	2	Hospital	1
Automatic Sprinklers	2	Hotels	13
Bakeries	5	Ice House	1
Banks	3	Laundries	4
Barber Shops	2	Locomotive Round House	1
Bath Room (public)	1	Locomotive Stand Pipe	1
Baths (private)	519	Locomotive Water Tank	1
Bicycle Factory	1	Machine Shops	6
Blacksmith Shop	1	Masonic Temple	1
Boarding Houses	6	Mattress Factory	1
Boilers (power)	60	Meat Markets	6
Boiler Shops	4	Mortar Yard	1
Bottling Works	4	Motor Pumps	76
Box Factories	3	Offices	13
Brewery	1	Opera House	1
Business Blocks	31	Organ Motors	4
Business College	1	Paint Shop	1
Butcher Shops	3	Passenger Depots	2
Canning Works	1	Photograph Gallery	1
Carpenter Shop	1	Pipe Factory	1
Carpet Cleaning	1	Planing Mills	9
Chemical Works	1	Plow Factory	1
Churches	6	Printing offices	7
Club Rooms	2	Railroad Coach-yard	1
Coal and Wood Yards	2	Restaurants	3
County Court House	1	Saloons	16
County Jail	1	Salt Blocks	2
Cracker Factory	1	Saw Mills	5
Creamery Package Factory	1	Sausage Factory	1
Cross Arm Factory	1	Schools	4
Crystal Water Works	1	Seed House	1
Drainage Pump	1	Shade Roller Factory	1
Drill House	1	Stables (hotel)	2
Dwellings	689	Stables (mill)	2
Electric Light Works	1	Stables (livery)	7
Elevator Tanks	5	Stables (private)	114
Fire Pipes	20	Stave and Heading Factory	1
Fish Market	1	Stores	85
Flouring Mills	2	Street Car Barn	1
Foundries	4	Telegraph Office	1
Freight Depot	1	Telephone Exchange	1
Gas Engines	4	Warehouse	1
Government Building	1	Water Closets and Urinals	1428
Green Houses	5	Water Motor	1
Halls (public)	11	Wooden Ware Works	1
Hose for Sprinkling	575		

City Uses for Which no Payment is Made.

Baths in City Buildings	7
City Hall	1
Electric Light Works (3 boilers)	1
Hose for Sprinkling Parks	9
Public Drinking Fountains	8
Public Fire Hydrants	417
Public Watering Troughs	13
Ornamental Fountains in Parks	4
Stable for Police Department and Street Commissioner (9 horses)	1
Steamer, Truck and Hose Houses (19 horses)	6
Street Sprinkler Carts	2
Water Closets and Urinals in City Buildings	35

Uses Shut Off January 1, 1902.

Armory	1	Hotels	11
Ashery	1	Kindling Factory	1
Barber Shops	3	Machine Shop	1
Baths (private)	22	Market Garden	1
Blacksmith Shop	1	Motor Pumps	2
Block	1	Offices	3
Boarding Houses	3	Pasture	1
Boat Dock	1	Planing Mill	1
Boilers (power)	3	Plumber Shop	1
Box Factory	1	Saloons	7
Buildings, not completed	4	Salt Block	1
Car Barn	1	Saw Mill	1
Cemeteries	6	Shops	11
Churches	3	Skating Rink	1
Cigar Factory	1	Stables (private)	19
Drill House	1	Stable (livery)	1
Dry Kiln	1	Stone Yard	1
Dwellings	230	Stores	12
Fair Grounds	1	Tin Shop	1
Fire Pipes	4	Vacant Lots	40
Flouring Mill	1	Warehouse	1
Hall	1	Water Closets and Urinals	10
Harness Shop	1	Wood Yard	1
Hose for Sprinkling	173		





WATER DEPARTMENT

THIRTY-FIRST ANNUAL REPORT



DECEMBER 31ST

1902

BAY CITY, MICH.





THIRTY-FIRST

ANNUAL REPORT

—OF THE—

WATER DEPARTMENT

—OF—

BAY CITY, MICHIGAN

December 31, 1902

BAY CITY, MICH.
PRESS OF C. & J. GREGORY CO.
1903

Water Department

1903

COMMISSIONERS

WALTER S. COUSINS, PRESIDENT
(Term Expires Sept. 6th, 1906)

BENJAMIN F. RAY
(Term Expires Sept. 6th, 1903)

ROBERT E. BOUSFIELD
(Term Expires Sept. 6th, 1904)

HOMER E. BUCK
(Term Expires Sept. 6th, 1905)

ARTHUR H. INGRAHAM
(Term Expires Sept. 6th, 1907)

ARTHUR F. BROOKMAN
(Term Expires Sept. 6th, 1908)

SAMUEL MEISTER
(Term Expires Sept. 6th, 1909

OFFICERS AND EMPLOYEES

E. L. DUNBAR ..... Supt. and Secretary
T. A. DELZELL ..... Office Assistant
F. H. COLLINS ..... Inspector
L. D. CARPENTER ..... Reservoir Keeper
A. B. VERITY ..... First Engineer
JAMES E. DARLING ..... Second Engineer
ALBERT D. CASE ..... Fireman
DANIEL WOODBURY ..... Fireman

Superintendent's Report

To the Honorable Board of Water Commissioners of Bay City, Michigan:

GENTLEMEN: I have the honor to submit the thirty-first annual report of the Water Department of this city, the same being for the year ending December 31st, 1902.

The receipts from water rates show an increase of $478.32 from the year 1901; the amount charged on the roll of 1902 being $341.12 in excess of the amount on roll of 1901. The receipts from miscellaneous sources were nearly $1,000.00 less than for the previous year, making the total receipts for the year from all sources $515.72 less than for the year 1901. This reduction in the receipts from miscellaneous sources was due to the fact that they were considerably above the normal in 1901 owing to the fact that during that year there was received for repairing break in intake pipe $546.91 and old Wyckoff pipe taken out was sold for $565.50; only $43.00 was received during 1902 for these items.

The expenditures of the department were $2,546.56 more than in 1901; and $418.82 more than the receipts. The increase in expenditures over 1901 was $224.93 in operating expenses, due to the cost of the electric survey of the distribution system hereinafter referred to and which amounted to $328.50, and the increased cost of fuel for the pumping station which was $756.15 more than for the previous year. The expenditures in other sections of the operating department were usually less than for the previous year.

The increase on account of construction, $2,321.63, was due to the fact that after all plans had been made and pipe ordered for such lines as the board considered necessary and within their means to lay, Center avenue was ordered paved be-

tween Johnson and Trumbull streets, and it became necessary to lay nearly one half mile of pipe in addition to that before ordered.

There is about 24 miles of Wyckoff mains in service, of which about 6¾ miles were laid between 1872-1876, all of which is in very unsafe condition; about 5½ miles were laid between 1879-1887, a portion of which is in nearly as bad condition as the section first laid; the balance of the Wyckoff pipe in service is in good condition, but it is not considered advisable to leave any of this pipe in service on any street which is improved with a permanent pavement on concrete foundation. In view of the fact that there must be many miles of our streets repaved within the next few years, and it is the settled policy of the city government that all pavements hereafter laid be placed on concrete foundation, it will be impossible for this department to replace these pipes as fast as necessary without assistance, either by issuing bonds to pay for such renewals or by raising funds by direct taxation.

The total quantity of water pumped during the year was about 13 million gallons less than for the year 1901. This is accounted for by the fact that there was much rainfall during the year 1902 and there was less water used for sprinkling lawns, also the North American Chemical Company were not running to their full capacity for a considerable portion of the year and the quantity of water supplied to that industry was more than 30 million gallons less than during the year 1901. These facts also give the reason for there having been more than 20 million gallons less water supplied through meters than during the year 1901.

That there is an enormous waste of water in the city from some cause is shown from the fact that with one half of our services in number and practically all of the services where there is a large legitimate use of water under meter, less than 20 per cent of the water pumped passes through the meters.

While a considerable percentage of this loss is probably due to undiscovered leaks in the old mains, it is more than probable that a much larger portion of it is due to defective plumbing and water closets blocked open to permit a constant flow of water. This waste being upon services not under meter, would be prevented by the judicious application of a few hundred more meters.

In the report of this department for 1901 your attention was called to the danger of electrolytic action on our pipe system. In compliance with the recommendation in that report, the services of Mr. A. A. Knudson, of New York, an electrical engineer of wide experience in that line were secured, and during the month of June the gentleman named made a very thorough electrical survey of our entire pipe system. Mr. Knudson's report was submitted to the board in July, and while no serious damage to the pipe system was discovered as having yet taken place, the conditions were such as to warrant grave apprehension as to the result in the near future if those conditions were not improved.

At the time the survey was made, the street railway company were engaged in the work of renewing the bonding of their tracks in outlaying sections of their system where it was known to be in bad condition.

This work was continued on sections where the survey showed defects to exist; the street railway company also in compliance with Mr. Knudson's suggestion placed additional return wires from their rails to the power station. While it is believed that the improvements have relieved the condition to some extent, the degree of such relief can only be determined by expert examination with proper instruments, and I would advise that Mr. Knudson's services be called in during the present season for the purpose of determining present conditions.

The survey developed one fact which was a surprise to Engineer Knudson as to your superintendent. This was that

the Wyckoff mains were conductors of electric currents, instead of circuit breakers as we had supposed; a very perceptible current being found in many of the Wyckoff mains. The survey developed the fact which substantiated our own theory, that the most dangerous conditions exist on Water street in front of the power station of the street railway company where a difference of potential was discovered between the water pipe and the return wires of street railway company reaching as high as 9 6-10 volts, the pipe being positive to the return wires. The water pipe at this point showed perceptible pitting from electrolytic action, the iron being in some places eaten to a depth of fully one-eighth of an inch. As this action was the result of but the few months exposure since the power station was moved to its present location, if it continues at the same rate it will require but a short time to destroy this pipe.



FINANCIAL

Receipts

The total receipts of the department from all sources during the year were $25,134.53 as follows:

From water rates roll of 1893	$ 10 97	
From water rates roll of 1896	6 00	
From water rates roll of 1897	14 96	
From water rates roll of 1898	9 35	
From water rates roll of 1899	32 80	
From water rates roll of 1900	172 07	
From water rates roll of 1901	1,135 22	
From water rates roll of 1902	23,162 69	
Total from water rates		$ 24,544.06

From miscellaneous sources (maintenance):

From service connections	243 00	
From plumbers' licenses	60 00	
From repairs to intake pipe from bay	30 00	
Total miscellaneous (maintenance)		333 00

From miscellaneous sources (construction):

From cast iron pipe sold	204 68	
From Wyckoff pipe sold	13 00	
From valves sold	6 50	
From laying pipe acount	33 29	
Total miscellaneous (construction)		257 47
Total		$ 25,134 53

The receipts by months were:

January	$ 1,390 11	
February	490 59	
March	1,190 25	
April	1,905 50	
May	1,096 37	
June	1,334 12	
July	2,308 77	
August	951 09	
September	1,501 62	
October	2,197 97	
November	1,028 13	
December	9,740 01	
Total		$ 25,134 53

Expenditures

The expenditures of the department during the year were $25,553.35, as follows:

MAINTENANCE ACCOUNTS.

Office department:

Salaries	$ 2,600 00	
Expenses	272 05	

Street and service department:

Repairs on main distribution	952 06	
Repairs and care of services	462 51	
Repair and care of water meters	898 33	
Service connections	116 38	

Inlet department:

Repairs and care of inlet works at bay	507 64	
Repairs and care of inlet pipe from bay	30 00	
Repairs and care of inlet from river	75	

Pumping department:

Salaries	3,669 70	
Fuel	3,779 06	
Oil, packing and supplies	363 12	
Repairs on engines and boilers	124 18	

Repairs to buildings and grounds:

Repairs to engine house	101 64	
Repairs to engine house grounds	27 68	
Repairs to house at bay	19 55	
Total for maintenance and operating expenses		$ 13,924 65

CONSTRUCTION ACCOUNTS.

Water meter account

New meters	564 21	
Setting meters	19 69	

Main distribution:

Cast iron pipe	6,614 78	
Valves	482 17	
Fire hydrants	276 50	
Laying pipe	3,671 35	
Total for construction accounts		11,628 70
Total expenditures		$ 25,553 35

The expenditures by months were:

January	$ 991 22	
February	1,157 59	
March	1,516 68	
April	2,989 91	
May	6,017 65	
June	3,974 34	
July	2,374 40	
August	1,777 28	
September	1,126 40	
October	1,169 28	
November	1,098 78	
December	1,359 82	
Total		$ 25,553 35

Account with Water Works Fund.	Dr.	Cr.
Balance in fund, January 1st, 1902	$ 13,878 67	
Cash collections deposited with City Treas.	25,134 53	
By recorder's warrants No. 395 to 406 inclusive		25,553 35
Balance in fund December 31st, 1902		13,459 85
	$ 39,013 20	$ 39,013 20

Account with City Treasurer as Treasurer of Board	Dr.	Cr.
To Recorder's warrants No. 395 to 406 inclusive	$ 25,553 35	
By paid Secretary's orders Nos. 6159 to 6648 inclu.		25,553 35
	$ 25,553 35	$ 25,553 35

Ledger Balances, 1902

Ledger F		Dr.	Cr.
Folio 151	Water rates roll of 1902		$ 23,162 69
" 153	Water rates roll of 1901		1,135 22
" 154	Water rates roll of 1900		172 07
" 154	Water rates roll of 1899		32 80
" 155	Water rates roll of 1898		9 35
" 155	Water rates roll of 1897		14 96
" 155	Water rates roll of 1896		6 00
" 156	Water rates roll of 1893		10 97
" 157	Plumbers' licenses		60 00
" 164	Service connections		126 62
" 177	Wyckoff pipe		13 00
" 158	City water works fund		418 82
" 159	Office department salaries	$ 2,600 00	
" 160	Office department expenses	272 05	
" 162	Street and service department repairs and care of services	462 51	
" 165	Inlet department repairs and care of inlet works at bay	507 64	
" 166	Inlet department repairs and care of inlet from river	75	
" 167	Pumping department salaries	3,669 70	
" 168	Pumping department fuel	3,779 06	

"	169	Pumping department, oil, packing and supplies		363 12	
"	170	Pumping department, repairs on engines and boilers		124 18	
"	171	Street and Service department, repairs on main distribution		952 06	
"	172	Repairs on buildings, etc., repairs to engine house		101 64	
"	172	Repairs on buildings, etc., repairs to engine house grounds		27 68	
"	173	Repairs on buildings, etc., repairs to house at bay		19 55	
"	173	Street and service department, repairs and care of water meters		898 33	
"	174	Water meters, new meters		564 21	
"	174	Water meters, setting meters		19 69	
"	175	Main distribution, cast iron pipe		6,410 10	
"	175	Main distribution, valves		475 67	
"	175	Main distribution, fire hydrants		276 50	
"	177	Main distribution, laying pipes		3,638 06	
			$ 25,162 50		$ 25,162 50

Ledger Balances December 31st, 1902

Ledger Folio	F.		Dr.	Cr
	1	Bay City bonds ($452,000.00)		$443,045 87
"	1	Water assessment frontage on pipe		736 07
"	28	Service connections		3,958 16
"	29	Plumbers' licenses		1,060 20
"	30	Rents, dockage, etc.		2,627 32
"	32	Water rates		549,269 48
"	34	City water works fund	13,459 85	
"	2	Construction—real estate	6,724 83	
"	2	" dock, tramway and store shed	1,882 63	
"	3	" engine house, chimney and wells	21,401 42	
"	3	" engine foundations, boiler foundations and arches	6,777 45	
"	4	" pumping machinery	59,427 72	
"	4	" inlet from Saginaw river	4,799 46	
"	5	" inlet from Saginaw bay	84,778 37	
"	5	" reservoir, breakwaters, etc. at bay	24,713 78	
"	6	" cast iron pipe and branch castings	134,550 19	
"	6	" Wyckoff patent pipe	125,862 81	
"	7	" valves for street mains	17,645 36	
"	7	" public fire hydrants	16,259 97	
"	8	" laying pipe	77,347 83	
"	8	" building at bay	1,299 40	
"	9	" water meters	20,344 43	
"	9	" furniture and fixtures	887 96	
"	10	" implement account	1,713 61	
"	10	" engineering and general superintendence	7,856 17	
"	11	" travelling expenses	306 29	

Folio 11	Construction—insurance.....	29 00		
" 12	" interest, discount, and commissions	4,224 17		
" 15	Maintenance—office expenses and salaries	74,514 03		
" 16	" repairs and care of hydrants, valves and pipes	24,642 84		
" 17	" repairs and care of water meters	9,484 31		
" 18	" repairs and care of inlet works and pipes	39,563 06		
" 19	" repairs to engine house and grounds	4,337 00		
" 20	" repairs to dock	13 38		
" 20	" interest (on bills payable)	3,709 84		
" 21	" implement account	1,129 37		
" 22	" engineer's and firemen's wages	106,271 28		
" 23	" fuel	82,217 27		
" 24	" oil, packing and supplies..	10,803 03		
" 25	" repairs to pumping machinery	9,835 02		
" 26	" repairs to boiler arches..	1,832 52		
" 27	" repairs to engine foundations	51 46		
		$1,000,697 11	1,000,697 11	

Water Rates

The total amount charged on roll for 1902 for water supplied was as follows:

For water supplied at fixed rates.....	$ 9,703 10	
For water supplied through meters.....	15,291 80	
		$ 24,994 90

The amount collected on roll of 1902 was:

From fixed rates	$ 8,961 84	
From metered water	14,200 85	
		$ 23,162 69

Amounts uncollected on roll of 1902:

From fixed rates	$ 741 26	
From metered water	1,090 95	
		$ 1,832 21

The amount collected during the year from previous years' rolls was $1,381.37, as follows:

From fixed rates	$ 478 39	
From metered water	902 98	
		$ 1,381 37

The total amount of water rates collected during the year was $24,544.06 as follows:

From fixed rates, domestic	$ 8,764 53	
From fixed rates, manufacturing	675 70	
From metered water, domestic	10.193 50	
From metered water, manufacturing	4.910 33	
		$ 24,544 06

The total amount collected and uncollected on each year's rolls since the works commenced operating has been as follows:

YEAR	Collected	Uncollected	Total on Roll
1873 January 1st to April 30th	$ 728 82	$	$ 728 82
1873-4, May 1st, 1873, to April 30th, 1874	5,440 80	1 60	5,442 40
1874-5, May 1st, 1874, to April 30th, 1875	6.908 16	44 85	6,953 01
1875, May 1st to December 31st	7,269 55	28 46	7,298 01
1876	9,571 26	82 73	9,653 99
1877	9,604 26	134 19	9,738 45
1878	10,078 15	324 71	10,402 86
1879	11,708 97	136 07	11,845 04
1880	13,155 74	120 25	13,275 99
1881	15,002 61	212 40	15,215 01
1882	17,352 47	158 85	17,511 32
1883	18,713 46	98 64	18,812 10
1884	18,892 02	129 89	19,021 91
1885	19,716 73	269 58	19,986 31
1886	19,356 61	118 74	19,475 35
1887	19,436 25	87 00	19,523 25
1888	21,278 62	120 80	21,399 42
1889	22.120 47	113 03	22,233 50
1890	23.297 81	202 81	23,500 62
1891	24,638 33	267 53	24 905 86
1892	24,189 21	276 32	24,465 53
1893	23,686 66	473 47	24,160 13
1894	22 844 10	523 16	23,367 26
1895	22,939 51	291 34	23 230 85
1896	23,121 76	330 37	23,452 13
1897	22.018 58	344 61	22,363 19
1898	22,093 20	676 49	22,769 69
1899	22 934 57	555 32	23,489 89
1900	24,245 63	435 82	24,681 45
1901	23,762 48	889 86	24,652 34
1902	23,162 69	1832 21	24,994 90
Totals	$549,269 48	$ 9,271 10	$558,540 58

Bonds and Interest

Series No. 16 of the original issue of Water Works bonds amounting to $10,000.00, bearing date August 15th, 1872, payable February 16th, 1902, were paid when due. The payment of these bonds was made from money received from the following described sources: Balance in water works refunding bond account, being premiums received on water works refunding bonds previously sold, $5,161.68; from the general fund, $4,838.32.

Refunding bonds No. 1 to 10 for the sum of $1,000.00 each, were issued bearing date June 1st, 1902, payable June 1st, 1932, with interest at 4 per cent per annum, payable annually, the proceeds from the sale of which were used to retire series No. 35 of the original issue bearing date June 1st, 1875. The amount of interest falling due during the year on water works bonds and water works refunding bonds was $20,390.00, which was paid from moneys raised by tax levy. Total amount paid to date for interest on water works bonds, $823,125.00.

Total amount of water works bonds paid and retired to date (not refunded) $110,000.00.

Total amount of water works bonds outstanding, $342,000, of which $139,000 were issued in 1872, 1873, 1874 and 1875, and bear interest at 8 per cent per annum, $75,000.00 were issued in 1891 and bear interest at 5 per cent per annum, and $128,000 are water works refunding bonds bearing interest at 4 per cent per annum.

Bonds Outstanding December 31st, 1902

Series	Date of Issue	Date Payable	Amount	Interest
No. 17	Aug. 15, 1872	Feb. 16, 1903	$10,000 00	8 %
No. 18	" 15, 1872	" 16, 1904	9,000 00	8 %
No. 19	" 15, 1873	" 16, 1905	10,000 00	8 %
No. 20	" 15, 1873	" 16, 1906	10,000 00	8 %
No. 21	" 15, 1873	" 16, 1907	10,000 00	8 %
No. 22	" 15, 1873	" 16, 1908	10,000 00	8 %
No. 23	" 15, 1873	" 16, 1909	10,000 00	8 %
No. 24	Feb. 15, 1874	" 16, 1910	10,000 00	8 %
No. 25	Apr. 15, 1874	Apr. 15, 1911	10,000 00	8 %
No. 26	" 15, 1874	" 15, 1912	10,000 00	8 %
No. 27	" 15, 1874	" 15, 1913	20,000 00	8 %
No. 36	June 1, 1875	June 1, 1903	10,000 00	8 %
No. 37	" 1, 1875	" 1, 1904	10,000 00	8 %
Not seried—				
No. 1 to 25	May 1, 1891	May 1, 1905	25,000 00	5 %
No. 26 to 50	" 1, 1891	" 1, 1911	25,000 00	5 %
No 51 to 63	" 1 1891	" 1, 1917	12,500 00	5 %
No. 64 to 76	" 1, 1891	" 1, 1918	12,500 00	5 %
Refunding Bonds—				
No. 1 to 20	Oct. 1, 1895	Oct. 1, 1920	20,000 00	4 %
No 1 to 20	" 1, 1896	" 1, 1921	20,000 00	4 %
No. 1 to 20	" 15, 1897	" 15, 1927	20,000 00	4 %
No. 1 to 18	" 15, 1898	" 15, 1928	18,000 00	4 %
No. 1 to 20	Mar. 1, 1900	Mar. 1, 1930	20,000 00	4 %
No. 1 to 20	" 1, 1901	" 1, 1931	20,000 00	4 %
No. 1 to 10	June 1, 1902	June 1, 1932	10,000 00	4 %

SOURCE OF SUPPLY

The total length of time during the year that the river has been called upon to help out the supply was 98 hours and 43 minutes, and the estimated quantity of water taken from the river was 6,800,000 gallons. The balance of the water supplied was taken from the bay.

The dates on which the river valve was partly opened were as follows:

January 11, 28 minutes, on account of fire.
January 27, 1 hour, 30 minutes on account of fire.
February 13, 40 minutes, on account of fire.
February 25, 1 hour, on account of fire.
March 16 and 17, 7 hours 10 minutes, on account of fire.
March 18, 4 hours 30 minutes, on account of anchor ice.
March 18, 1 hour 20 minutes, on account of fire.
April 16, 4 hours, on account of repairs at bay.
May 31, 5 hours, on account of fire.
June 12, 1 hour, on account of fire.
August 29, 7 hours 30 minutes, on account of fire.
October 13, 6 hours, on account of low water.
October 25, 25 minutes, on account of fire.
November 13, 8 hours on account of low water.
November 13, 30 minutes, on account of fire.
November 14, 5 hours, on account of low water.
November 17, 1 hour, on account of fire.
November 29, 6 hours, on account of low water.
December 5, 6 hours, on account of anchor ice.
December 9, 15 hours, on account of low water.
December 15, 40 minutes, on account of fire.
December 16, 16 hours, on account of low water.

Total	98 hours, 43 minutes
On account of extraordinary demands for fire service, 28 hours, 13 minutes.	
On account of obstruction by anchor ice, 10 hours, 30 minutes.	
On account of supply shut off for repairs, 4 hours.	
On account of inadequate supply from bay for ordinary service, 56 hours.	
Total,	98 hours, 43 minutes

Attention is called to the fact that 56 hours, or more than one-half of this time that the river was called upon to help out the supply, was due to an insufficient supply from the bay for ordinary purposes. At the several times on which this occurred there was a heavy southwest wind prevailing, and there was a consequent lowering of the head of water on the

intake pipe, but inasmuch as these dates are all within the time that the sugar factories and chemical works were in operation, it is fair to presume that the supply to these places had some influence in the matter.

MAIN DISTRIBUTION

The distribution system has been extended during the year as follows:

On north side Center avenue from Green avenue to Livingstone avenue.

On south side Center avenue from Johnson street to Livingstone avenue

On Livingstone avenue across Center Avenue.

In Van Buren street from Trumbull street to Belinda street.

In Dolson street from Van Buren street to Mercer street.

In line of alley between Washington avenue and Adams street from Second street to First street.

In alley between Monroe street and Jackson street from Second street to First street.

In Broadway from Cass avenue to Thirty-eighth street.

Old mains have been replaced by cast iron pipe as follows:

On north side Center avenue from Johnson street to Green avenue.

In Trumbull street across Center avenue.

In alley between Washington avenue and Adams street from First street to Woodside avenue.

In Woodside avenue from alley between Washington avenue and Adams street to alley between Adams and Jefferson street.

In alley between Adams and Jefferson street from Second street to Center avenue.

Additional fire hydrants have been placed as follows:

On north side Center avenue, 312 feet east of Park avenue.

On north side Center avenue at west line Ringgold street.

On south side Center avenue 400 feet east of Green avenue.

On south side Center avenue, 323 feet east of Trumbull street.

On south side Center avenue, 268 feet east of Johnson street

On northeast corner of Van Buren street and Dolsen street.

On northwest corner of Fitzgerald street and Dolsen street.

On southwest corner of Mercer street and Dolsen street.

On southwest corner of First street and Jackson street.

On north side of Fifth avenue at alley between Adams street and Jefferson street.

On northeast corner of Broadway and Thrty-sixth street.

On northeast corner of Broadway and Thirty-seventh street.

On northeast corner of Broadway and Thirty-eighth street.

Changes in the location of hydrants before in service have been made as follows:

The hydrant before located on the north side of Center avenue 584 feet east of Trumbull street has been removed to a point 366 feet west of Park avenue.

The hydrant before located at the southeast corner of Center avenue and Trumbull street has been removed to the northeast corner of Center avenue and Trumbull street.

All other hydrants taken out on account of renewal of main pipes were reset in the same location as before.

The "Galvin" hydrant located at the southwest corner of Park avenue and North street has been removed and a "Holly" hydrant set in its place.

The amount expended during the year on account of the extension and renewal on the main distribution system was $11,044.80 as follows:

For cast iron pipe	$ 6,614 78	
For valves and valve boxes	482 17	
For fire hydrants	276 50	
For laying pipe	3,671 35	
		$ 11,044 80

The length of pipe laid during the year was:

10-inch cast iron	135	feet
8-inch cast iron	10	feet
6-inch cast iron	14,574½	feet
4-inch cast iron	129	feet
Total length of pipe laid	14,848½	feet

The length of pipe taken out, or abandoned, was:

10-inch cast iron	2½	feet
8-inch cast iron	6	feet
6-inch cast iron	81¼	feet
4-inch cast iron	30	feet
Total of cast iron pipe	119¾	feet
10-inch Wyckoff	102½	feet
6-inch Wyckoff	3,615¼	feet
4-inch Wyckoff	1,453	feet
3-inch Wyckoff	319	feet
Total of Wyckoff pipe	5,489¾	feet
Total length of pipe taken out or abandoned	5,609½	feet
Net increase in length of pipe in system	9,239	feet

The number of valves set in the distribution system during the year was:

10-inch Flower pattern	4
6-inch Flower pattern	19
4-inch Flower pattern	13
4-inch Eddy	5
Total valves set	41

The number of valves taken out was:

10-inch Flower pattern	1
6-inch Flower pattern	6
4-inch Flower pattern	7
Total number of valves taken out	14
Net increase in number of valves	27

The number of fire hydrants set during the year was:

Holly hydrants	5
Matthews hydrants	16
Total number of hydrants set	21

The number of hydrants taken out was:

Holly hydrants	3
Matthews hydrants	4
Galvin hydrants	1
Total number of hydrants taken out	8
Net increase in number of hydrants	13

Main Pipe in Service December 31st, 1902

Size	Cast Iron	Wyckoff	Total
20 inch	9,563 ft.		9,563 ft.
16 inch	13,778 ft.		13,778 ft.
12 inch	9,083 ft.		9,083 ft.
10 inch	18,063 ft. 3 in.	24,480 ft. 6 in.	42,543 ft. 9 in.
8 inch	20,201 ft. 8 in.	16,177 ft. 7 in.	36,378 ft. 3 in.
6 inch	47,153 ft. 3 in.	71,557 ft. 6 in.	118,710 ft. 9 in.
4 inch	4,099 ft. 9 in.	15,284 ft. 5 in.	19,384 ft. 2 in.
Totals	121,940 ft. 11 in.	127,500 ft.	249,440 ft. 11 in.

Total cast iron, 23 miles, 501 feet.
Total Wyckoff, 24 miles, 780 feet.
Total mains, 47 miles, 1,281 feet.

Percentage of each size:

20 inch	3.83 per cent
16 inch	5.52 per cent
12 inch	3.64 per cent
10 inch	17.06 per cent
8 inch	14.58 per cent
6 inch	47.58 per cent
4 inch	7.77 per cent

Valves in Service December 31st, 1902

	20 in.	16 in.	12 in.	10 in.	8 in.	6 in.	4 in.	2 in.	Total
Flower Pattern	4	9	3	42	56	206	347	1	668
Galvin Pattern	....	.....	2	....	....	6	42	.....	50
Eddy Pattern	.....	....	.....	.....	.....	5	11	.....	16
Brown Pattern	.....	.....	1	.....	.....	1	.....	.....	2
Totals	4	9	6	42	56	218	400	1	736

Blow off valves included in above:

Two	6 inch
Eleven	4 inch

Fire Hydrants in Service December 31st, 1902

Matthews, 6-inch inlet, 3 hose nozzles, gated	32
Matthews, 4-inch inlet, 2 hose nozzles	227
Bourbon, 6-inch inlet, 3 hose nozzles, gated	5
Bourbon, 4-inch inlet, 2 hose nozzles	10
Holly, 4-inch inlet, 2 hose nozzles	132
Gaskill, 4-inch inlet, 2 hose nozzles	16
Galvin, 6-inch inlet, 3 hose nozzles, gated	6
Galvin, 4-inch inlet, 2 hose nozzles	2
Total	430

WATER METERS

The amount expended during the year on account of the extension of the meter system was $583.90, as follows:

For new meters bought	$564 21
For setting meters	19 69
	$583 90
The number of meters in service January 1, 1902	881
The number of meters set in 1902 was	90
The number of meters taken out in 1902 was	33
Net increase in number of meters in service	57
Total number of meters in service December 31, 1902	938

Meters purchased in 1902:

22 ⅝ inch Union Rotary "A."
17 ⅝ inch Nash "A."
10 ⅝ inch Hersey Disc "F."
6 ⅝ inch Thomson "Lambert."
6 ⅝ inch Keystone.

Meters Set in 1902

	3-in.	1-in.	¾-in.	⅝-in.	½-in.	⅜-in.	Total
Union Rotary	2			2			4
Union Rotary A				21			21
Crown		5	1		1	3	10
Empire		1			1		2
Nash A				14			14
Worthington				1			1
Hersey Disc F				10			10
Thomson				4			4
Thomson B				1	1		2
Thomson Lambert				6			6
Trident				9			9
Westinghouse				1			1
Keystone				6			6
Totals	2	6	1	75	3	3	90

Meters Taken Out in 1902

	3-in.	2-in.	1-in.	⅝-in.	½-in.	Total
Union Rotary	2			2		4
Union Rotary A				1		1
Union Duplex				1		1
Crown			6		1	7
Empire			1		2	3
Gem		1				1
Nash A				2		2
Worthington				2		2
Hersey			2	3		5
Thomson			1	3		4
Trident				3		3
Totals	2	1	10	17	3	33

Meters in Service December 31st, 1902

	8-in.	6-in.	4-in.	3-in.	2-in.	1½-in.	1-in.	¾-in.	⅝-in.	½-in.	⅜-in.	Total
Union Rotary	1	1	4	15	6	4	3	1	41	..	.	76
Union Rotary A	....	....	....	....	...	1	...	.....	50	.....	.....	51
Union Duplex	....	....	....	....	..	....	....	.....	18	...	....	18
Columbia	....	....	.	....	....	....	....	.....	29	...		29
Crown	..	....	....	....	....	....	19	34	....	35	42	132
Empire	....	....	..	...	....	....	3	31	....	17	...	51
Empire A	..	..	....	....	....	....	....	.....	11	..	...	11
Empire AA	....	....	...	....	....	....	....	.....	39	....	....	39
Nash	....	....	....	....	....	....	....	.....	31	.....	....	31
Nash A	....	....	....	.	....	....	....	.....	36	..	....	36
Worthington	....	....	..	....	6	3	....	.....	14	.....	....	23
Hersey	....	....	..	....	....	....	....	5	53	....	...	58
Hersey Disc	..	....	..	....	....	....	....	.....	41	....	..	41
Hersey Disc F	....	....	..	....	....	....	....	.....	10	.....	....	10
Thomson	...	....	....	....	....	..	1	2	101	...	....	104
Thomson B	....	....	....	....	....	....	....	.....	18	72	..	90
Thomson Lambert	....	....	....	....	....	....	....	.....	36	....	.	36
Trident	....	....	....	....	....	....	....	..	126	....	..	126
Westinghouse	...	....	....	....	....	....	....	.....	4	.....		4
Pittsburg Disc	....	....	....	...	..	....	....	.....	6	....	....	6
Keystone	....	....	....	....	....	....	....	..	6	....	..	6
Totals	1	1	4	15	12	8	26	73	640	116	42	938

Meters in Stock December 31st, 1902

	4-in.	3-in.	2-in.	1½-in.	1-in.	¾-in.	⅝-in.	½-in.	Total
Union Rotary	2	6	....	.....	....	.....	.....	.....	8
Union Rotary A	.....	.....	.....	.....	.....	.....	3	.....	3
Union Duplex	.....	.....	.. .	.....	..	.....	4	.....	4
Crown	....	.....	.. .	1	6	.....	.....	1	8
Empire	.....	.....	.....	.....	3	4	.....	8	15
Gem	.....	. ..	1	..	.....	.....	.....	.....	1
Nash A	...	.....	.....	....	. ..	.....	5	.....	5
Worthington	.....	.....	1	3	.....	....	2	...	6
Hersey	.....	.....	.....	....	2	.....	3	.....	5
Thompson	.....	.....	.....	....	1	.....	1	.....	2
Westinghouse	.....	.....	....	.....	....	.....	2	.....	2
Totals	2	6	2	4	12	4	20	9	59

Total cost of meter system to December 31st, 1902.

938 meters in service cost	$	17,065 57
59 meters in stock cost		2,115 55
Meter fittings in stock		73 29
Cost of setting 140 meters (taken out)		1,056 67
Cost of 3 motor indicators (taken out)		33 35
	$	20,344 43

PUMPING STATION

The amount expended during the year for operating the pumping engines was $7,936.06, as follows:

For engineer's and firemen's wages	$	3,669 70
For fuel		3,779 06
For oil, packing and engineer's supplies		363 12
For repairs on engines and boilers		124 18
	$	7,936 06

The Gaskill engines and pumps were run 8,701 hours and 35 minutes and pumped 1,036,730,737 gallons.

The Quadruplex engines and pumps were run 528 hours and 55 minutes and pumped 32,623,580 gallons.

The H. P. engine and rotary pumps were run 4 hours and 30 minutes and pumped 307,530 gallons.

The total quantity of water pumped during the year as indicated by the revolutions of the pumps was 1,069,661,847 gallons, of which 15,669,626 gallons were pumped against a fire pressure of from 70 to 100 pounds per square inch and 1,053,992,221 gallons were pumped against a domestic pressure of 40 pounds per square inch at the pressure gauge in the pumping station. The average head against which all of the water was pumped, including lift of suction from level in wells, was 113 feet.

The net cost of operating the pumping engines was $7,852.74, as follows:

Engineers' and firemen's wages	$	3,669 70
Fuel consumed		3,721 99
Oil, packing and supplies used		336 87
Repairs on engines and boilers		124 18
	$	7,852 74

The quantity of fuel at the pumping station January 1st, 1902, was:

128,000 pounds Wenona mine slack, cost	$	80 00

Fuel has been received during the year as follows:

3,360,800 pounds Wenona mine slack, cost	$	2,100 49
531,600 pounds Wenona mine lump		332 24
858,400 pounds Ohio lump		1,098 19
Unloading from cars		237 52
4,750,800 pounds coal, cost		3,768 44
8 cords of wood		10 62
Total fuel received	$	3,779 06

Fuel on hand December 31st, 1902:

100,000 pounds Wenona mine slack, cost	$	67 50
50,000 pounds Ohio lump, cost		66 25
2½ cords wood, cost		3 32
	$	137 07

Fuel consumed during the year:

4,728,800 pounds coal, cost	$	3,714 69
5½ cords wood, cost		7 30
	$	3,721 99

Average cost of coal per ton, in bins, $1.57.

The value of oil, packing and engineer's supplies on hand January 1st, 1902, was	$	99 51
Delivered at pumping station during the year		363 12
	$	462 63
On hand December 31st, 1902		125 76
Used during the year	$	336 87

The cost of pumping based on net cost of running the pumping engines ($7,852.74) was:

Per million gallons pumped	$7 34
Per million gallons raised 100 feet	$6 50

The cost of fuel consumed ($3,721.99) was:

Per million gallons pumped	$3 48
Per million gallons raised 100 feet	$3 08

Pumping Plant

BOILERS.

One boiler (No. 1) horizontal tubular (installed in 1872), 16 feet long, 66 inches in diameter, containing 105 tubes 16 feet long and 2¾ inches interior diameter. (This boiler is not used).

Two boilers (Nos. 4 and 5) horizontal tubular (installed in 1893) 16 feet long, 60 inches in diameter, each containing 48 tubes 16 feet long and 3¾ inches interior diameter.

One boiler (No. 3) horizontal tubular (installed in 1898) 16 feet long, 66 inches in diameter, containing 64 tubes, 16 feet long and 3¾ inches interior diameter.

One boiler (No. 2) horizontal tubular (installed in 1899) 16 feet long, 66 inches in diameter, containing 64 tubes, 16 feet long and 3¾ inches interior diameter.

The area of grate surface under each boiler is: No. 1, 27½ square feet; Nos. 4 and 5, each 22½ square feet; Nos. 2 and 3 each, 24¾ square feet.

Heating surface: No. 1 (½ shell 138.24 square feet, entire tubes, 1,209.11 square feet) 1,347.75 square feet; Nos. 4 and 5 each, (½ shell 125.66 square feet, entire tubes 753.98 square feet) 879.64 square feet; Nos. 2 and 3 each, (½ shell 138.24 square feet, entire tubes 1,005.31 square feet) 1,143.55 square feet.

ENGINES AND PUMPS.

One Gaskill horizontal compound condensing crank and fly wheel pumping engine, (installed in 1886) maximum capacity 5,000,000 gallons in 24 hours.

One Holly quadruplex, compound condensing crank and fly wheel pumping engine (installed in 1872) maximum capacity 3,000,000 gallons in 24 hours.

One horizontal high pressure piston engine (installed in 1879) driving through gears, two No. 10 Holly rotary pumps (installed in 1872,) maximum capacity 2,500,000 gallons in 24 hours.

Capacity of Gaskill pumps per revolution, 119 gallons.

Capacity of quadruplex pumps per revolution, 55 gallons.

Capacity of rotary pumps per revolution, 17 gallons.

The quantity of water pumped each year since the works commenced supplying water has been as follows:

1873.....	142,477,725 gallons	1888.....	872,990,164 gallons
1874.....	294,714,798 "	1889.....	944,472,747 "
1875.....	416,756,579 "	1890.....	988,771,453 "
1876.....	518,197,129 "	1891.....	1,014,475,024 "
1877.....	538,847,186 "	1892.....	962,953,662 "
1878.....	530,197,397 "	1893.....	1,044,256,236 "
1879.....	672,344,128 "	1894.....	1,024,735,621 "
1880.....	827,067,372 "	1895.....	1,122,363,460 "
1881.....	944,382,043 "	1896.....	1,009,523,471 "
1882.....	*775,642,466 "	1897.....	944,545,290 "
1883.....	773,942,702 "	1898.....	1,038,794,253 "
1884.....	831,867,463 "	1899.....	1,118,599,631 "
1885.....	836,970,016 "	1900.....	1,142,339,229 "
1886.....	779,761,852 "	1901.....	1,082,691,511 "
1887.....	827,195,000 "	1902.....	1,069,661,847 "

* Commenced metering

WATER PUMPED, 1902

Month	Gaskill Engines			Quadruplex Engines			H. P Engines and Rotary Pumps			Totals		Fires					
	Hours Run	Revolutions	Gallons Pumped	Hours Run	Revolutions	Gallons Pumped	Hours Run	Revolutions	Gallons Pumped	Gallons Pumped	Daily Average	No. Alarms	Hours Run	Highest Pressure	Lowest Pressure	Average Pressure	Gallons Pumped
January.....	744.00	783,019	93,179,261	.....	.....	.....	.....	.....	.....	93,179,261	3,005,783	13	4.36	70	70	70	759,220
February..	666.45	733,624	87,301,256	5.15	16,415	902,825	.....	.....	.....	88,204,081	3,150,146	16	7.16	70	70	70	1,229,151
March.....	743.30	736,347	87,625,293	4.30	9,641	530,255	.....	.....	.....	88,155,548	2,843,727	25	15.57	70	70	70	3,286,345
April.....	698.20	666,932	79,364,908	21.40	46,096	2,535,280	....	.....	.....	81,900,188	2,730,006	21	6.35	70	70	70	1,095,752
May.....	731.15	725,631	86,350,089	16.00	35,101	1,930,720	.....	.....	.....	88,280,809	2,847,768	16	8.33	80	70	76.2	1,605,716
June.....	720.00	699,076	83,190,044	1.20	2,621	144,155	.....	.....	.....	83,334,199	2,777,807	12	4.57	80	70	74.3	977,869
July.....	740.20	710,486	84,547,834	3.40	8,154	461,970	.....	.....	.....	85,012,804	2,742,319	13	3.44	70	70	70	903,449
August.....	743.00	757,313	90,120,247	6.10	12,527	688,985	.....	.....	.....	90,809,232	2,929,330	14	11.35	80	70	75.3	2,704,277
September..	717.10	751,749	89,458,131	2.50	6,678	367,290	1.50	9,231	156,027	89,982,348	2,999,412	9	4.59	70	70	70	855,610
October.....	744.00	761,919	90,668,361	1.25	2,606	143,330	.....	.....	.....	90,811,691	2,929,409	8	5.21	100	70	82.8	1,098,424
November..	717.00	733,011	87,228,309	3.00	6,643	365,365	....	.....	.....	87,593,674	2,919,789	11	3.16	70	70	70	567,392
December...	*736.15	*1,033,632	*77,697,004	463.05	446,371	24,550,405	2.40	8,850	150,603	102,398,012	3,303,162	15	4.26	70	70	70	826,421
Totals	8,701.35	9,092,739	1,036,730,737	528.55	593,156	32,623,580	4.30	18,080	307,580	1,069,661,817	2,930,580	173	81.15	100	70	72.8	15,669,926

*During the month of December, the left Gaskill Engine and Pump were run 47 hours, with the right engine and pump shut down, making 761,482 revolutions at one half capacity.

Greatest quantity of water pumped in one day, 4,231,327 gallons, August 20th.

Least quantity of water pumped in one day, 2,139,000 gallons, June 20th.

Daily average for the year, 2,930,580 gallons.

GENERAL MAINTENANCE AND REPAIRS.

The amount expended during the year for general maintenance and repairs, not including cost of operating pumping engines and interest on bonds, was $5988.59, as follows:

Office salaries	$ 2,600 00	
Office expenses	272 05	
Repairs on main distribution	952 06	
Repairs and care of services	462 51	
Repairs and care of water meters	898 33	
Service connections	116 38	
Repairs and care of inlet works at bay	507 64	
Repairs and care of inlet pipe from bay	30 00	
Repairs and care of inlet from river	75	
Repairs to engine house	101 64	
Repairs to engine house grounds	27 68	
Repairs to house at bay	19 55	
		$ 5,988 59

The details of these expenditures were as follows:

For office salaries:

Superintendent and Secretary's salary	$ 1,800 00	
Office assistant	800 00	
		$ 2,600 00

For office expenses:

Postage stamps, postal cards and stamped envelopes	$ 99 40	
Blank books, stationery and printing	152 25	
Filing cases and binding pamphlets	4 50	
Guage dials and express	4 45	
Telephone and telegraph service	7 05	
Drafts	2 40	
Water analysis	2 00	
		$ 272 05

Repairs on main distribution:

Labor repairing leaks in Wyckoff pipe	$ 234 99	
Pipe for repairing Wyckoff mains	76 72	
Labor repairing cast iron mains	33 12	
Examining and blowing off hydrants	74 00	
Repairs on hydrants	145 32	
Repairing valves and valve boxes	9 87	
Moving hydrants	27 09	
Brick man hole for sewer	8 65	
Drayage	4 75	
Tools and repairing tools	9 05	
Electrical survey	328 50	
		$ 952 06

Repairs and care of services:

Labor repairing private mains	$ 29 75	
Pipe for repairing private mains	10 60	
Repairs on lead services and shut offs	20 94	
Repairs on service connections	15 12	
Taking out abandoned services	11 13	
Examining services and notifying	153 05	
Turning on and off water	221 92	
		$ 462 51

Repairs and care of water meters:

Reading meters	$ 324 12	
Labor on repairing and cleaning meters	314 67	
Shop repairs and parts from manufacturers	107 47	
Changing meters and taking out abandoned meters	31 50	
Tools, pipe and fittings	10 80	
Packing and protecting from frost	8 09	
Repairing and draining meter boxes	101 68	
		$ 898 33

Service connections:

120 corporation stops	$ 74 87	
Labor inserting taps	41 51	
		$ 116 38

Repairs and care of inlet works at bay:

Salary of reservoir keeper	$ 420 00	
Repairs on brick work in basin	13 45	
Cleaning inlet cut and basin	57 82	
Tools	4 37	
Rent of telephone	12 00	
		$ 507 64

Repairs and care of inlet pipe from bay:

Tapping pipe for Michigan Chemical Co		$ 30 00

Repairs and care of river inlet:

Cleaning out intake		$ 75

Repairs to engine house:

Repainting engine house and coal sheds	$ 59 45	
Repairing windows, roof and floor	17 89	
Repairing sewer and cleaning pits	17 50	
Repairs on electric light wiring	1 60	
Covering Monitor nozzles	5 20	
		$ 101 64

Repairs to engine house grounds:

Grading cinders	$ 7 63	
Mowing lawn	11 55	
Cleaning wells	8 50	
		$ 27 68

Repairs to house at bay:

Lumber, nails and paint	$ 8 81	
Extension for chimney	10 74	
		$ 19 55

The number of leaks in the main pipes of the system was 66; of which 64 were in the Wyckoff mains and 2 were in the cast iron mains. Of the leaks in Wyckoff mains 13 were burst pipes required the insertion of new sections, 46 were leaks in joints repaired by plugging and 5 were knot holes repaired in the same manner as the joint leaks.

One leak in cast iron main was a lead joint, repaired by relaying a few short sections and one was a cracked pipe requiring the insertion of a new section.

The fire hydrant on Saginaw street between Tenth and Eleventh street was moved a short distance to make way for the street railway company to lay a track to their power house.

All of the fire hydrants have been carefully inspected twice during the year, besides the continuous examination which is conducted during severely cold weather, for the detection of frozen hydrants. During the month of February, 25 hydrants were found frozen by employes of this department and at once placed in working order.

The number of hydrants repaired by this department was 54, and one hydrant has been replaced by a new one.

The number of service pipes repaired by this department was 14; of which 10 were leaks in small private mains and 4 were leaks in lead services or shut off valves.

The number of services shut off during the year by employes of this department was 357; of which 42 were shut off for non-payment of water rates, 22 for leaks, 167 premises vacant, and 126 at the request of the consumer.

The number of services opened by employes of this department was 338.

The number of meters found not registering properly was 278; of which 179 were broken or so worn in some of their parts as to require repairs, and 99 were obstructed by rust or other extraneous matter and only required cleaning. Of the meters requiring repairs 5 were broken by frost and 4 had the

rubber piston ruined by hot water. Three meters were sent to the manufacturers for repairs and 176 were repaired by the inspector with parts procured from the makers. 16 meters were removed permanently on account of the services with which they were connected being abandoned and 17 were taken out and replaced by others.

Service Connections and Services

The number of service connections connected with the main pipes during the year was 130, as follows:

	1"	¾"	⅝"	½"	Total
With Cast Iron Mains	6	6	49	30	91
With Wyckoff Mains	.....	4	19	16	39
Totals	6	10	68	46	130

Of these connections, 56 were put in to replace connections taken out or abandoned and 74 were for supply to new services.

The number of service connections taken out was 73, as follows:

	Branches		Corporation Stops				Total
	4"	2"	1"	¾"	⅝"	½"	
With Cast Iron Mains	1	.....	.....	.....	....	.....	1
With Wyckoff Mains	1	1	5	22	18	25	72
Totals	2	1	5	22	18	25	73

The total number of service connections in the main pipes December 31st, 1902, was 2,169, as follows:

	Branches					Corporation Stops							Total
	8″	6″	4″	3″	2″	2″	1¼″	1″	¾″	⅝″	½″	⅜″	
With Cast Iron Mains	2	6	16	3	4	2	3	84	133	354	335	5	947
With Wyckoff Mains	....	1	9	1	1	....	....	90	250	374	490	6	1222
Totals	2	7	25	4	5	2	3	174	383	728	825	11	2169

Six service connections heretofore reported abandoned have been taken out during the year and five connections have been abandoned but not taken out.

Total number of abandoned service connections now in main pipes, which may be renewed, 92, as follows:

	Branches		Corporation Stops					Total
	6″	4″	1″	¾″	⅝″	½″	⅜″	
In Cast Iron Mains	1	1	8	12	3	14	4	43
In Wyckoff Mains	....	2	10	12	7	16	2	49
Totals	1	3	18	24	10	30	6	92

Total number of service connections with service connected 2,077
Total number of separate services supplied.....2,318
Number of services open December 31st, 1902.....1 737
Number of services shut off December 31st, 1902..... 581

Of the services shut off, 148 are for supplying lawn hose or similar uses not required during the winter months; 79 are to vacant lots from which the buildings have been removed; 37 are supplies to buildings temporarily vacant; 12 are for supply to premises on which the plumbing is not completed; 37 represent a portion of the supply to premises now receiving their supply from other services; leaving 268 services shut off from occupied premises requiring a water supply, but not at present supplied from the city water works.

The total cost of maintaining and operating the plant, including the interest on the bonded debt, which was paid by tax levy, was $34,314.65.

As an offset to this expense the department is entitled to credit as follows:

Collected from water rates	$ 24,544 06	
Received from miscellaneous sources, not on construction accounts	333 00	
		$ 24,877 06

Value of supply for public uses from which no revenue is received:

430 public fire hydrants @ $45.00	$ 19,350 00	
14 public watering troughs @ $150.00	2,100 00	
8 public drinking fountains @ $25.00	300 00	
4 ornamental fountains @ $50.00	200 00	
City Hall	200 00	
City electric light plant	150 00	
6 Fire Department houses	150 00	
Street sprinkling	500 00	
Sprinkling public parks	150 00	
Flushing public sewers	2,000 00	
		$ 25,000 00
		$ 49,877 06

All of which is respectfully submitted,

E. L. DUNBAR,

Superintendent and Secretary.

SUMMARY OF STATISTICS

For the Year Ending December 31st, 1902

(In form recommended by the New England Water Works Association)

BAY CITY WATER WORKS

Bay City, Bay County, Mich.

GENERAL STATISTICS.

Population by census of 1900, 27,628.
Date of construction, 1872.
By whom owned, Bay City.
Source of supply, Saginaw Bay.
Mode of supply, pumping.

PUMPING STATISTICS.

1. Builders of pumping machinery, Holly Manf'g Co.
2. Description of fuel used
   - *a.* Kind, coal.
   - *b.* Brand of coal, bituminous slack.
   - *c.* Average price of coal per gross ton, delivered, $1.65.
   - *d.* Percentage of ash, 23 per cent.
   - *e.* Wood, price per cord, $1.33.
3. Coal consumed for year, 4,728,800 pounds.
4. Pounds of wood consumed divided by 3—equivalent amount of coal, 3,667 pounds.
5. Total equivalent coal consumed for the year 4,732,467 pounds.
6. Total pumpage for the year 1,069,661,847 gallons, without allowance for slip.
8. Average dynamic head against which pumps work, 113 feet.
9. Number of gallons pumped per pound of equivalent coal, 226.
10. Duty $= \frac{1,069,661,847 \times 8.34 \times 100 \times 113}{4,732,467} = 21,301,161.$

    Cost of pumping figured on pumping station expenses, $7,852.74.
11. Per million gallons pumped, $7.34.
12. Per million gallons raised one foot dynamic, $.065.

FINANCIAL STATISTICS.

RECEIPTS.

Balance brought forward—		
a—From ordinary (maintenance, receipts..		$ 13,878 67
From water rates—		
A—Fixed rates	$ 9,440 23	
B—Meter rates	15,103 83	
C—Total from consumers		24,544 06
K—From tax levy		20,390 00
L—From bond issue		10,000 00
M—From other sources—		
Miscellaneous maintenance		333 00
Miscellaneous coustruction		257 47
Premium on bonds before sold		5,161 68
General fund		4,838 32
		$ 79,403 20

EXPENDITURES.

Water Works Maintenance—		
AA—Operation (management and repairs)	$13,924.65	
CC—Total maintenance		$ 13,924 65
DD—Interest on bonds		20,390 00
CC & DD—		34,314 65
EE—Payment of bonds		20,000 00
Water Works Construction—		
GG—Extension of mains	$11,044 80	
II—Extension of meters	583 90	
KK—Total construction		11,628 70
MM—Balance		
aa—Ordinary	$13,459 85	
		13,459 85
		79,403 20

Disposition of balance—Deposited with City Treasurer.

O—Net cost of works to date.....	$618,832 85
P—Bonded debt to date	342,000 00
R—Average rate of interest, 5.85 per cent.	

STATISTICS OF CONSUMPTION.

1. Estimated popularion at date, 28,000.
2. Estimated population on lines of pipe, 20,500.
3. Estimated population supplied, 17,000.
4. Total consumption for the year, 1,069,661,847 gallons.
5. Passed through meters, 193,573,637 gallons.
6. Percentage of consumption metered, 18.1 per cent.
7. Average daily consumption, 2,930,580 gallons.
8. Gallons per day to each inhabitant, 105.
9. Gallons per day to each consumer, 172.
10. Gallons per day to each service, 1,264.
11. Cost of supplying water per million gallons, figured on total maintenance ($13,924.65), $13.02.
12. Total cost of supplying water per million gallons, figured on total maintenance and interest on bonds ($34,314.65), $32.08.

STATISTICS RELATING TO DISTRIBUTION SYSTEM—MAINS.

1. Kind of pipe, cast iron and Wyckoff.
2. Sizes, 4 inch to 20 inch.
3. Extended, 14,848 feet during year.
4. Discontinued, 5,609 feet during year.
5. Total now in use, 47¼ miles.
6. Cost of repairs per mile, $20.15.
7. Number of leaks per mile, 1.4.
9. Number of hydrants added during the year, public, 13.
10. Number of hydrants now in use, public, 430.
11. Number of stop gates added during year, 27.
12. Number of stop gates now in use, 736.
13. Number of stop gates smaller than 4 inch, 1.
14. Number of blow offs, 13.
15. Range of pressure on mains, 35 lbs. to 100 lbs.

SERVICES.

16. Kind of pipe, lead, wrought iron and cast iron.
17. Sizes, ¾ inch to 8 inch.
21. Number of services added during year, 62.
22. Number now in use, 2,318.
25. Number of meters added, 57.
26. Number now in use, 938.
27. Percentage of service metered, 40 per cent.
28. Percentage of receipts from metered water, 61.5 per cent.

Uses Supplied at Fixed Rates January 1st, 1903

Armory	1	Green Houses	2
Automatic Sprinklers	3	Halls (public)	4
Bakeries	2	Harness Shops	3
Banks	2	Hose for Sprinkling	188
Barber Shops	6	Hospital	1
Bath Room (public)	2	Hotels	10
Bath Room (Turkish)	1	Laundries	2
Baths (private)	129	Motor Pumps	8
Billiard Room	1	Offices	13
Blacksmith Shops	4	Paint Shop	1
Boarding Houses	4	Passenger Depots	2
Boilers (power)	4	Pawn Shops	2
Bottling Works	5	Photograph Galleries	3
Brass Foundry	1	Plumber Shops	3
Business Blocks	11	Printing Offices	2
Butcher Shops	8	Restaurants	8
Carriage Shops	2	Saloons	38
Chicory Factory	1	Schools	14
Churches	3	Stables (mill	4
Cigar Factories	2	Stables (private)	61
Clothes Cleaning	2	Stables (livery)	5
Coal Yard	1	Stables (hotel)	2
Dairy	1	Stone Yard	1
Dwellings	605	Stores	71
Dye Works	1	Telegraph Office	1
Express Office	1	Telephone Exchange	1
Fire Pipes	3	Tin Shop	2
Fish Market	1	Undertaker's Rooms	1
Gas Engines	2	Warehouses	3
Gas Works	1	Water Closets and Urinals	669

Uses Shut Off January 1st, 1903

Ashery	1	Hotels	7
Barber Shops	3	Machine Shop	1
Baths (private)	18	Market Garden	1
Blacksmith Shop	2	Motor Pumps	2
Block	2	Offices	9
Boarding Houses	2	Pasture	1
Boat Dock	1	Planing Mill	1
Boilers (power)	1	Plumber Shop	2
Buildings, not completed	12	Saloons	4
Car Barn	1	Salt Block	1
Cemeteries	6	Shops	8
Churches	2	Stables (private)	29
Cigar Factory	1	Stables (livery)	1
Dairy	1	Stone Yard	1
Drill House	1	Stores	51
Dry Kiln	1	Tin Shop	1
Dwellings	209	Vacant Lots	72
Fair Grounds	1	Warehouse	3
Fire Pipes	3	Water Closets and Urinals	80
Harness Shop	1	Wood Yard	1
Hose for Sprinkling	145		

City Uses for Which no Payment is Made

Baths in City Buildings	7
City Hall	1
Electric Light Works (3 boilers)	1
Hose for Sprinkling Parks	9
Public Drinking Fountains	8
Public Fire Hydrants	430
Public Watering Troughs	14
Ornamental Fountains in Parks	4
Stable for Police Department and Street Commissioner (9 horses)	1
Steamer, Truck and Hose Houses (19 horses)	6
Street Sprinkler Carts	2
Water Closets and Urinals in City Buildings	35

Uses Supplied Through Meters January 1st, 1903

Asheries	2	Halls (public)	6
Automatic Sprinklers	2	Hose for Sprinkling	627
Bakeries	5	Hospital	1
Banks	3	Hotels	13
Barber Shops	2	Knitting Works	1
Bath Room (public)	1	Laundries	4
Baths (private)	582	Locomotive Round House.	1
Bicycle Factory	1	Locomotive Stand Pipe	1
Blacksmith Shop	2	Locomotive Water Tank	1
Boarding Houses	8	Machine Shops	6
Boilers (power)	52	Masonic Temple	1
Boiler Shops	4	Mattress Factory	1
Bottling Works	4	Motor Pumps	82
Box Factories	3	Offices	13
Brewery	1	Opera House	1
Business Blocks	31	Organ Motors	4
Business College	1	Paint Shop	1
Butcher Shops	8	Passenger Depots	2
Carpenter Shop	1	Photograph Gallery	1
Carpet Cleaning	1	Pipe Factory	1
Chemical Works	1	Planing Mills	9
Children's Home	1	Plow Factory	1
Churches	6	Printing Offices	5
Club Rooms	2	Railroad Coach Yard	1
Coal and Wood Yards	2	Restaurants	2
County Court House	1	Saloons	19
County Jail	1	Salt Blocks	2
Cracker factory	1	Saw Mills	4
Creamery Package Factory	1	Sausage Factory	1
Cross Arm Factory	1	Schools	4
Crystal Water Works	1	Seed House	1
Dairy	1	Shade Roller Factory	1
Drainage Pump	1	Shirt Waist Factory	1
Drill House	1	Stables (hotel)	2
Dwellings	739	Stables (mill)	4
Electric Light Works	1	Stables (livery)	7
Elevator Tanks	5	Stables (private)	111
Fire Pipes	17	Stave and Heading Factory	1
Fish Market	1	Stores	90
Flouring Mills	2	Telegraph Office	1
Foundries	6	Telephone Exchange	1
Freight Depot	1	Warehouse	2
Gas Engines	4	Water Closets and Urinals.	1496
Government Building	1	Water Motors	1
Green Houses	4	Wooden Ware Works	1





WATER DEPARTMENT

THIRTY-SECOND ANNUAL REPORT



December 31st
1903

BAY CITY, MICHIGAN




CITY HALL

THIRTY-SECOND

ANNUAL REPORT

—OF THE—

WATER DEPARTMENT

—OF—

BAY CITY, MICHIGAN

December 31, 1903.

BAY CITY, MICH.
PRESS OF C. & J. GREGORY CO.
1904

Water Department

1904

COMMISSIONERS

WALTER S. COUSINS, President
(Term Expires Sept. 6th, 1906)

ROBERT E. BOUSFIELD
(Term Expires Sept. 6th, 1904)
(Removed from city Oct., 1903)

HOMER E. BUCK
(Term Expires Sept. 6th, 1905)

ARTHUR H. INGRAHAM
(Term Expires Sept. 6th, 1907)

ARTHUR F. BROOKMAN
(Term Expires Sept. 6th, 1908)

SAMUEL MEISTER
(Term Expires Sept. 6th, 1909)

BENJAMIN F. RAY
(Term Expires Sept. 6th, 1910)

OFFICERS AND EMPLOYEES

E. L. Dunbar.....Supt. and Secretary
T. A. Delzell.....Assistant Secretary
F. H. Collins.....Inspector
L. D. Carpenter.....Reservoir Keeper
A. B. Verity.....First Engineer
Jas. E. Darling.....Second Engineer
Albert D. Case.....Fireman
Daniel Woodbury.....Fireman

To the Honorable, the Mayor and Common Council of Bay City, Michigan:

Gentlemen:—The Board of Water Commissioners respectfully submit herewith the thirty-second Annual Report of the Water Department, showing the operation of that department for the year ending Dec. 31st, 1903:

W. S. COUSINS, President.
HOMER E. BUCK,
ARTHUR H. INGRAHAM,
ARTHUR F. BROOKMAN,
SAMUEL MEISTER,
B. F. RAY,
Commissioners of Water Works.

Superintendent's Report

To the Honorable Board of Water Commissioners of Bay City, Mich.:

Gentlemen:—I herewith submit my Thirty-Second Annual Report, the same being for the year ending December 31st, 1903:

The receipts from water rates show an increase of $678.44 over the year 1902, the amount charged on the roll of 1903 being $767.16 more than on the roll of 1902.

The expenditures of the department were $3,253.94 more than in 1902 and $2,656.84 more than the receipts. The increase in expenditures was nearly all in the operating expenses, and mainly in the pumping department, on account of repairs on the Gaskill engines, and the increased cost of fuel due to the higher price paid for coal.

About 1¼ miles of Wyckoff mains have been taken out or abandoned during the year, of which less than ½ mile was of the old pipe heretofore reported as unsafe. There is still nearly 23 miles of the Wyckoff mains in service, of which about 10 miles is not in suitable condition for further use. Of the 83 leaks reported on this pipe, 19 were bursted pipe, all but two of which were on lines of pipe which have been before reported as not in safe condition.

The quantity of water taken from the river and the length of time the river was called upon to help out the supply was considerably in excess of the year 1902. This excess was largely due to the draft upon the intake from the bay by the sugar factories. I would advise that, before these factories start again, they be required to make such changes in their method of taking water from said intake as will absolutely prevent their taking any water from that pipe when the demands of the city require the full supply.

The total quantity of water pumped during the year was 34,550,934 gallons more than in 1902. About 22 millions of this excess went to the North American Chemical Company, which company used over 70 milion gallons during 1903, and a little more than 48 million gallons in 1902. The balance of the increase is accounted for by the larger number of leaks in the main distribution system discovered, and a probable increase in undiscovered leaks in the old pipes.

The matter of electrolysis as affecting the system of pipeage has not received the attention that its importance demands, and which the electrical survey made by Engineer Knudson in 1902 would warrant. It is hoped that during the present year we may be able to more definitely determine the condition of the iron mains in the most exposed locations.



FINANCIAL.

Receipts.

The receipts of the department during the year were $26,160.45 as follows:

From water rates roll of 1883	$ 3.80	
From water rates roll of 1884	.50	
From water rates roll of 1893	5.00	
From water rates roll of 1894	7.87	
From water rates roll of 1896	16.00	
From water rates roll of 1899	9.00	
From water rates roll of 1900	72.60	
From water rates roll of 1901	199.20	
From water rates roll of 1902	1,145.60	
From water rates roll of 1903	23,762.93	
Total from water rates		$25,222.50

From miscellaneous sources (maintenance):

From service connections	$ 300.00	
From old service taps sold	83.80	
From plumbers' licenses	35.00	
Total from miscellaneous (maintenance)		$ 418.80

From miscellaneous sources (construction):

From water meter account	$ 10.00	
From cast iron pipe account	30.91	
From Wyckoff pipe account	404.60	
From valve account	8.50	
From laying pipe account	65.14	
Total from miscellaneous (construction)		$ 519.15
Total receipts		$ 26,160.45

The receipts by months were as follows:

January	$ 1,279.81	
February	501.19	
March	1,397.91	
April	1,809.01	
May	874.19	
June	2,042.82	
July	2,193.05	
August	1,212.25	
September	1,547.61	
October	2,283.94	
November	808.57	
December	10,210.10	
Total		$ 26,160.45

Expenditures.

The expenditures of the department during the year have been $28,817.29, as follows:

MAINTENANCE ACCOUNTS.

Office department:		
Salaries	$ 2,600.00	
Office expenses	298.40	
Street and service department:		
Repairs on main distribution	823.81	
Repairs and care of services	553.49	
Repairs and care of water meters	1,138.09	
Service connections	159.08	
Inlet department:		
Repairs and care of inlet works at bay	533.95	
Repairs to inlet from river	100.00	
Pumping department:		
Salaries	3,770.96	
Fuel	3,979.87	
Oil, packing and supplies	311.26	
Repairs on engines and boilers	1,786.69	
Repairs to buildings and grounds:		
Repairs to engine house	134.32	
Repairs and care of engine house grounds	33.17	
Total for maintenance and operating expenses		$ 16,223.09

CONSTRUCTION ACCOUNTS.

Water meters:		
New meters	$ 661.84	
Setting meters	135.66	
Main distribution:		
Cast iron pipe	7,063.31	
Valves and valve boxes	572.03	
Fire hydrants	331.01	
Laying pipe	3,827.35	
Total for construction		$ 12,594.20
Total expenditures		$ 28,817.29

The expenditures by months were:

January	$ 1,463.27	
February	2,173.62	
March	1,227.65	
April	1,599.65	
May	7,493.29	
June	4,112.45	
July	2,243.15	
August	2,570.32	
September	1,283.55	
October	1,657.40	
November	1,471.75	
December	1,521.19	
Total		$ 28,817.29

Account with Water Works Fund:

	Dr.	Cr.
Balance in fund January 1st, 1903	$ 13,459.85	
Cash collections deposited with City Treasurer	26,160.45	
By Recorder's warrants No. 407 to 418 inclusive		28,817.29
Balance in fund December 31st, 1903		10,803.01
Total	$39,620.30	$39,620.30

Account with City Treasurer as treasurer of board:

	Dr.	Cr.
To Recorder's warrants No. 407 to 418, inclusive	$ 28,817.29	
By paid Secretary's orders 6649 to 7090 inclusive		28,817.29
Total	$28,817.29	$28,817.29

LEDGER BALANCES FOR 1903.

Ledger F.

Folio	185	Water rates roll of 1903		$ 23,762.93
"	187	Water rates roll of 1902		1,145.60
"	188	Water rates roll of 1901		199.20
"	188	Water rates roll of 1900		72.60
"	187	Water rates roll of 1899		9.00
"	188	Water rates roll of 1896		16.00
"	189	Water rates roll of 1894		7.87
"	189	Water rates roll of 1893		5.00
"	189	Water rates roll of 1884		.50
"	189	Water rates roll of 1883		3.80
"	190	Plumbers' licenses		35.00
"	197	Service connections		224.72
"	307	Wyckoff pipe		404.60
"	191	City water works fund		2,656.84
"	192	Office department, salaries	2,600.00	
"	193	Office department, expenses	298.40	
"	198	Street and Service department, repairs on main distribution	823.81	
"	200	Street and Service department, repairs and care of services	553.49	
"	199	Street and Service department, repairs and care of water meters	1,138.09	
"	296	Inlet department, repairs and care of inlet works at bay	533.95	

"	297	Inlet department, repairs and care of inlet from river	100.00	
"	298	Pumping department, salaries	3,770.96	
"	299	Pumping department, fuel	3,979.87	
"	300	Pumping department, oil, packing and supplies	311.26	
"	301	Pumping department, repairs on engines and boilers	1,786.69	
"	302	Repairs to buildings, etc., repairs to engine house	134.32	
"	302	Repairs to buildings, etc., repairs to engine house grounds	33.17	
"	305	Water meter account, new meters	651.84	
"	305	Water meter account, setting meters	135.66	
"	307	Main distribution, cast iron pipe	7,032.40	
"	306	Main distribution, valves	563.53	
"	306	Main distribution, fire hydrants	334.01	
"	303	Main distribution, laying pipe	3,762.21	
		Total	$28,543.66	$28,543.66

LEDGER BALANCES DECEMBER 31ST, 1903.

Ledger Folio	F.		Dr.	Cr.
	1	Bay City bonds ($452,000.00)		$443,045.87
"	1	Water assessment, frontage on pipe		736.07
"	28	Service connections		4,182.88
"	29	Plumbers' licenses		1,095.20
"	30	Rents, dockage, etc		2,627.33
"	33	Water rates		574,491.98
"	34	City water works fund	10,803.01	
"	2	Construction—real estate	6,724.83	
"	2	" dock, tramway, store shed	1,882.63	
"	3	" engine house, chimney, wells	21,401.42	
"	3	" engine foundations, boiler foundations and arches	6,777.45	
"	4	" pumping machinery	59,427.72	
"	4	" inlet from river	4,799.46	
"	5	" inlet from bay	84,778.37	
"	5	" reservoir, breakwaters, etc., at bay	24,713.78	
"	6	" cast iron pipe and branches	141,582.59	
"	6	" Wyckoff patent pipe	125,458.21	
"	7	" valves	18,208.89	
"	7	" public fire hydrants	16,593.98	
"	8	" laying pipe	81,110.04	
"	8	" buildings at bay	1,299.40	
"	9	" furniture and fixtures	887.96	
"	10	" implements	1,713.61	
"	10	" engineering and general superintendence	7,856.17	
"	11	" traveling expenses	306.29	
"	11	" insurance	29.00	
"	12	" interest, discount and commissions	4,224.17	
"	12	" water meters	21,131.93	
"	15	Maintenance—office expenses and salaries	77,412.43	
"	16	" repairs and care of hydrants, valves and pipes	26,020.14	

Folio 17	Maintenance—	repairs and care of water meters	10,622.40	
" 18	"	repairs and care of inlet works	40,197.01	
" 19	"	repairs to engine house and grounds	4,504.49	
" 20	"	repairs to dock	13.38	
" 20	"	interest (on bills payable)	3,709.84	
" 21	"	implements	1,129.37	
" 22	"	engineer's and firemen's wages	110,042.24	
" 23	"	fuel	86,197.14	
" 24	"	oil, packing, supplies	11,114.29	
" 25	"	repairs to pumping machinery	11,621.71	
" 26	"	repairs to boiler arches	1,832.52	
" 27	"	repairs to engine foundations	51.46	
			$1,026,179.33	$1,026,179.33

Water Rates.

The total amount charged on roll of 1903 for water supplied was $25,761.59, as follows:

For water supplied at fixed rates	$ 9,839.91	
For water supplied through meters	15,921.68	
		$ 25,761.59

The amount collected on roll of 1903 was:

From fixed rates	$ 9,123.80	
From metered water	14,639.13	
		$ 23,762.93

Amount uncollected on roll of 1903:

From fixed rates	$ 716.11	
From metered water	1,282.55	
		$ 1,998.66

The amount collected during the year from previous years rolls was $1,459.57.

From fixed rates	$ 616.01	
From metered water	843.56	
		$ 1,459.57

The total amount collected during the year from water rates was $25.222.50, as follows:

From fixed rates, domestic	$ 9,111.97	
From fixed rates, manufacturing	627.84	
From metered water, domestic	$ 10,564.01	
From metered water, manufacturing	4,918.68	
Total from fixed rates		$ 9,739.81
Total from metered water		$ 15,482.69
		$ 25,222.50

Total amount collected and uncollected on each year's roll since the works commenced operating:

YEAR	Collected	Uncollected	Total on Roll
1873 January 1st to April 30th	$ 728 82	$	$ 728 82
1873-4, May 1st, 1873, to April 30th, 1874	5,440 80	1 60	5,442 40
1874-5, May 1st, 1874, to April 30th, 1875	6,908 16	44 85	6,953 01
1875 May 1st to December 31st	7,269 55	28 46	7,298 01
1876	9,571 26	82 73	9,653 99
1877	9,604 26	134 19	9,738 45
1878	10,078 15	324 71	10,402 86
1879	11,708 97	136 07	11,845 04
1880	13,155 74	120 25	13,275 99
1881	15,002 61	212 40	15,215 01
1882	17,352 47	158 85	17,511 32
1883	18,717 26	94 84	18,812 10
1884	18,892 52	129 39	19,021 91
1885	19,716 73	269 58	19,986 31
1886	19,356 61	118 74	19,475 35
1887	19,436 25	87 00	19,523 25
1888	21,278 62	120 80	21,399 42
1889	22,120 47	113 03	22,233 50
1890	23,297 81	202 81	23,500 62
1891	24,638 33	267 53	24,905 86
1892	24,189 21	276 32	24,465 53
1893	23,691 66	468 47	24,160 13
1894	22,851 97	507 41	23,359 38
1895	22,939 51	291 34	23,230 85
1896	23,137 76	304 37	23,442 13
1897	22,018 58	344 61	22,363 19
1898	22,093 20	676 49	22,769 69
1899	22,943 57	546 32	23,489 89
1900	24,318 23	363 22	24,681 45
1901	23,961 68	692 16	24,653 84
1902	24,308 29	686 14	24,994 43
1903	23,762 93	1,998 66	25,761 59
Totals	$574,491 98	$ 9,803 34	$584,295 32

BONDS AND INTEREST.

Series Nos. 17 and 36 of the original issue of Water Works bonds, bearing date August 15th, 1872, and June 1st, 1875, and payable February 16th, 1903, and June 1st, 1903, respectively, were paid from the proceeds of the sale of $20,000 Water Works refunding bonds of which $10,000 bear date February

1st, 1903, and are payable February 1st, 1933, and $10,000 bear date June 1st, 1903, and are payable June 1st, 1933, with interest at 4 per cent. per annum, payable annually.

The total amount of interest falling due during the year on water works bonds and water works refunding bonds was $19,190.00, which was paid from moneys raised by tax levy. Total amount of interest paid on water works bonds and water works refunding bonds to date, $842,315.00.

Water Works bonds paid and retired to date (not refunded), $110,000.00.

Amount of water works bonds and water works refunding bonds outstanding, $342,000.00; of which $119,000 were issued in 1872, 1873, 1874 and 1875, and bear interest at 8 per cent. per annum; $75,000 were issued in 1891 and bear interest at 5 per cent. per annum, and $148,000,000 are water works refunding bonds bearing interest at 4 per cent. per annum.

Water Works Bonds and Water Works Refunding Bonds Outstanding Dec. 31st, 1903:

Series	Date of Issue	Date Payable	Amount	Interest
No. 18	Aug. 15, 1872	Feb. 16, 1904	$ 9,000 00	8 %
No. 19	" 15, 1873	" 16, 1905	10,000 00	8 %
No. 20	" 15, 1873	" 16, 1906	10,000 00	8 %
No. 21	" 15, 1873	" 16, 1907	10,000 00	8 %
No. 22	" 15, 1873	" 16, 1908	10,000 00	8 %
No. 23	" 15, 1873	" 16, 1909	10,000 00	8 %
No. 24	Feb. 15, 1874	" 16, 1910	10,000 00	8 %
No. 25	Apr. 15, 1874	Apr. 15, 1911	10,000 00	8 %
No. 26	" 15, 1874	" 15, 1912	10,000 00	8 %
No. 27	" 15, 1874	" 15, 1913	20,000 00	8 %
No. 37	June 1, 1875	June 1, 1904	10,000 00	8 %
Not serled—				
Nos. 1 to 25	May 1, 1891	May 1, 1905	25,000 00	5 %
Nos. 26 to 50	" 1, 1891	" 1, 1911	25,000 00	5 %
Nos. 51 to 63	" 1, 1891	" 1, 1917	12,500 00	5 %
Nos. 64 to 76	" 1, 1891	" 1, 1918	12,500 00	5 %
Refunding Bonds—				
Nos. 1 to 20	Oct. 1, 1895	Oct. 1, 1920	20,000 00	4 %
Nos. 1 to 20	" 1, 1896	" 1, 1921	20,000 00	4 %
Nos. 1 to 20	" 15, 1897	" 15, 1927	20,000 00	4 %
Nos. 1 to 18	" 15, 1898	" 15, 1928	18,000 00	4 %
Nos. 1 to 20	Mar. 1, 1900	Mar. 1, 1930	20,000 00	4 %
Nos 1 to 20	" 1, 1901	" 1, 1931	20,000 00	4 %
Nos. 1 to 10	June 1, 1902	June 1, 1932	10,000 00	4 %
Nos. 1 to 10	Feb. 1, 1903	Feb. 1, 1933	10,000 00	4 %
Nos. 1 to 10	June 1, 1903	June 1, 1933	10,000 00	4 %
			$342,000 00	

Average rate of interest, $5\frac{1}{16}$ %.

SOURCE OF SUPPLY.

The connection with the river has been opened during the year, as follows:

January 16 and 17, 2 hours 40 minutes, for fire.
January 19, 30 minutes, for fire.
January 28 and 29, 2 hours 40 minutes, for fire .
February 7, 1 hour, for fire.
February 17, 10 hours, ordinary service.
February 18, 7 hours, ordinary service.
February 21, 10 hours, ordinary service.
March 7, 30 minutes, for fire.
March 24, 21 minutes, for fire.
March 24, 8 hours, ordinary service .
March 31, 30 minutes, for fire.
May 9, 30 minutes, for fire.
May 19, 6 hours 10 minutes, for fire.
July 5, 2 hours, for fire.
July 7, 30 minutes, for fire.
July 8, 6 hours, ordinary service.
July 13, 50 minutes, for fire.
July 14, 1 hour 30 minutes, for fire.
July 15, 6 hours, ordinary service.
July 16, 3 hours, ordinary service.
July 17, 8 hours, ordinary service.
July 18, 10 hours, ordinary service.
July 20, 4 hours, for fire.
August 22, 1 hour 42 minutes, break in main.
October 23, 2 hours, for fire.
November 3, 16 minutes, for fire.
November 3, 2 hours, break in main.
November 3, 9 hours, ordinary service.
November 9, 10 minutes, for fire.
November 10, 36 minutes, for fire.
November 10, 2 hours, ordinary service.
November 11, 3 hours, ordinary service.
November 12, 2 hours 30 minutes, ordinary service
November 13, 2 hours, ordinary service .
November 13, 40 minutes, for fire.
November 17, 5 hours, ordinary service.
November 18, 2 hours, anchor ice.
November 20, 1 hour, ordinary service.
November 26, 20 minutes, for fire.
November 27, 2 hours, for fire.
November 28, 1 hour, ordinary service.
December 2, 10 minutes, for fire.
December 3, 50 minutes, break in main.
December 4, 15 minutes, for fire.
December 7, 10 minutes, for fire.
December 14, 40 minutes, for fire.
December 18, 49 minutes, for fire.
December 23, 9 hours, ordinary service.
December 24, 12 minutes, for fire.
December 26, 1 hour 45 minutes, for fire.
December 26, 13 hours, ordinary service.
December 27, 7 hours, ordinary service.
December 28, 10 hours, ordinary service.

172 hours, 46 minutes.

To supply extra demand on account of fires, 33 hours, 44 minutes.
To supply extra demand on account of breaks, 4 hours, 32 minutes.
On account of obstruction by anchor ice, 2 hours.
Inadequate supply from bay for ordinary service, 132 hours, 30 minutes.

172 hours, 46 minutes.

The total quantity of water taken from the river is estimated at 8,100,000 gallons.

MAIN DISTRIBUTION.

Main pipes have been laid during the year in the following described streets and alleys not before supplied:

In Sixth street from Johnson street to Park avenue.

In Fifth avenue from Trumbull street to Park avenue.

In Park avenue from Center avenue to Fifth avenue.

In Water street from McEwan street to Atlantic street.

In Johnson street from Ninth street to Tenth street.

In alley between Jackson and Van Buren streets from Tenth street to Eleventh street.

Old mains have been replaced by cast iron pipes as fol: lows:

Cass avenue from Water street to Jennison avenue, with branch connections on each intersecting street to a point outside the side lines of Cass avenue.

Johnson street from Center avenue to south of Sixth street.

In alley between Jackson and Van Buren streets from Second street to Center avenue.

Additional fire hydrants have been set in the following locations:

On northwest corner of Cass avenue and Webster street.

On northwest corner of Cass avenue and Wilson street.

On northeast corner of Cass avenue and Marsac street.

On northeast corner of Cass Avenue and Stanton street.

On northeast corner of Tenth and Johnson street.

On north side Sixth street, 360 feet east of Johnson street.

On north side Sixth street, 362 feet west of Trumbull street.

On north side Sixth street, 393 feet east of Trumbull street.

On north side Sixth street, 419 feet west of Park avenue.

On north side Fifth avenue, 346 feet east of Trumbull street.

On north side Fifth avenue, 416 feet west of Park avenue.

On north side Water street, 364 feet west of Atlantic street.

On Water Works yard in line of Trumbull street, 170 feet north of Water street.

The fire hydrant before located at the southwest corner of Cass avenue and River street has been removed to the northeast corner of the same streets.

All other fire hydrants removed by reason of renewals of main pipes have been reset in the same location as before.

The length of pipe laid during the year was:

10-inch cast iron	362 feet
8-inch cast iron	4,461 feet
6-inch cast iron	6,613½ feet
4-inch cast iron	310 feet
Total length of pipe laid	11,746½ feet

The length of pipe taken out or abandoned was:

10-inch cast iron	68 feet 9 inches
8-inch cast iron	33 feet 6 inches
6-inch cast iron	25 feet 4 inches
Total cast iron pipe	127 feet 7 inches
10-inch Wyckoff	2,994 feet 9 inches
8-inch Wyckoff	1,239 feet
6-inch Wyckoff	1,030 feet
4-inch Wyckoff	1,414 feet
Total Wyckoff pipe	6,677 feet 9 inches
Total length of pipe taken out or abandoned	6,805 feet 4 inches
Net increase in length of pipe in service	4,941 feet 2 inches

The number of valves set during the year was:

10-inch Flower pattern	1
8-inch Flower Pattern	6
6-inch Flower pattern	20
4-inch Flower pattern	19
Total valves set	46

Valves taken out:

10-inch Flower pattern	4
8-inch Flower pattern	5
6-inch Flower pattern	6
4-inch Flower pattern	8
Total valves taken out	23
Net increase in number of valves in service	23

The number of fire hydrants set during the year was:

Holly hydrants	3
Matthews hydrants	16
Michigan Brass & Iron Works (compression)	2
Total hydrants set	21

The number of fire hydrants taken out was:

Holly hydrants	2
Matthews hydrants	6
Total hydrants taken out	8
Net increase in number of hydrants in service	13

Main Pipes in Service December 31st, 1903.

Size	Cast Iron	Wyckoff	Total
20 inch	9,563 ft.		9,563 ft.
16 inch	13,778 ft.		13,778 ft.
12 inch	9,083 ft.		9,083 ft.
10 inch	18,356 ft. 6 in.	21,485 ft. 9 in.	39,842 ft. 3 in.
8 inch	24,628 ft. 2 in.	14,938 ft. 7 in	39,566 ft. 9 in.
6 inch	53,741 ft. 5 in.	70,527 ft. 6 in.	124,268 ft. 11 in.
4 inch	4,409 ft. 9 in.	13,870 ft. 5 in.	18,280 ft. 2 in.
Totals	133,559 ft. 10 in.	120,822 ft. 3 in.	254,382 ft. 1 in.

Total cast iron mains, 25 miles, 1560 feet.
Total Wyckoff mains, 22 miles, 4,662 feet.
Total mains, 48 miles, 942 feet.

Percentage of each size of pipe:

20 inch	3.76 per cent.
16 inch	5.42 per cent.
12 inch	3.57 per cent.
10 inch	15.66 per cent.
8 inch	15.55 per cent.
6 inch	48.84 per cent.
4 inch	7.20 per cent.

Valves in Service December 31st, 1903.

	20 in.	16 in.	12 in.	10 in.	8 in.	6 in.	4 in.	3 in.	Total
Flower Pattern	4	9	3	39	57	220	358	1	691
Galvin Pattern			2			6	42		50
Eddy Pattern						5	11		16
Brown Pattern			1			1			2
Totals	4	9	6	39	57	232	411	1	759

Blow off valves included in above.

One	6 inch.
Eleven	4 inch

Fire Hydrants in Service December 31st, 1903.

Matthews, 6-inch inlet, 3 hose nozzles, gated	32
Matthews, 4-inch inlet, 2 hose nozzles	237
Bourbon, 6-inch inlet, 3 hose nozzles, gated	5
Bourbon, 4-inch inlet, 2 hose nozzles	10
Holly, 4-inch inlet, 2 hose nozzles	133
Gaskill, 4-inch inlet, 2 hose nozzles	16
Galvin, 4-inch inlet, 2 hose nozzles	2
M. B. & I. Works, 6-inch inlet, 3 hose nozzles, gated	6
M. B. & I. Works, 4-inch inlet, 2 hose nozzles	2
Total	443

The amount expended during the year on account of extensions and renewals of the main distribution system, was:

For cast iron pipe (234 576-2000 tons)	$ 7,063.31
For valves and valve boxes	572.03
For fire hydrants	334.01
For laying pipe	3,827.35
Total	$ 11,796.70

WATER METERS.

The number of water meters set during the year, 107; and the number taken out, 30.

Total number of meters in service December 31st, 1903, 1015; of which 95 are classed as manufacturing and 920 as domestic.

The number of new meters purchased during the year was 78, as follows:

⅝ inch Nash "A A X"	6
⅝ inch Hersey Disc "F"	30
⅝ inch Worthington Disc	5
⅝ inch Trident	15
⅝ inch Thomson Lambert	10
⅝ inch Keystone	12
	78

Meters Taken Out in 1903.

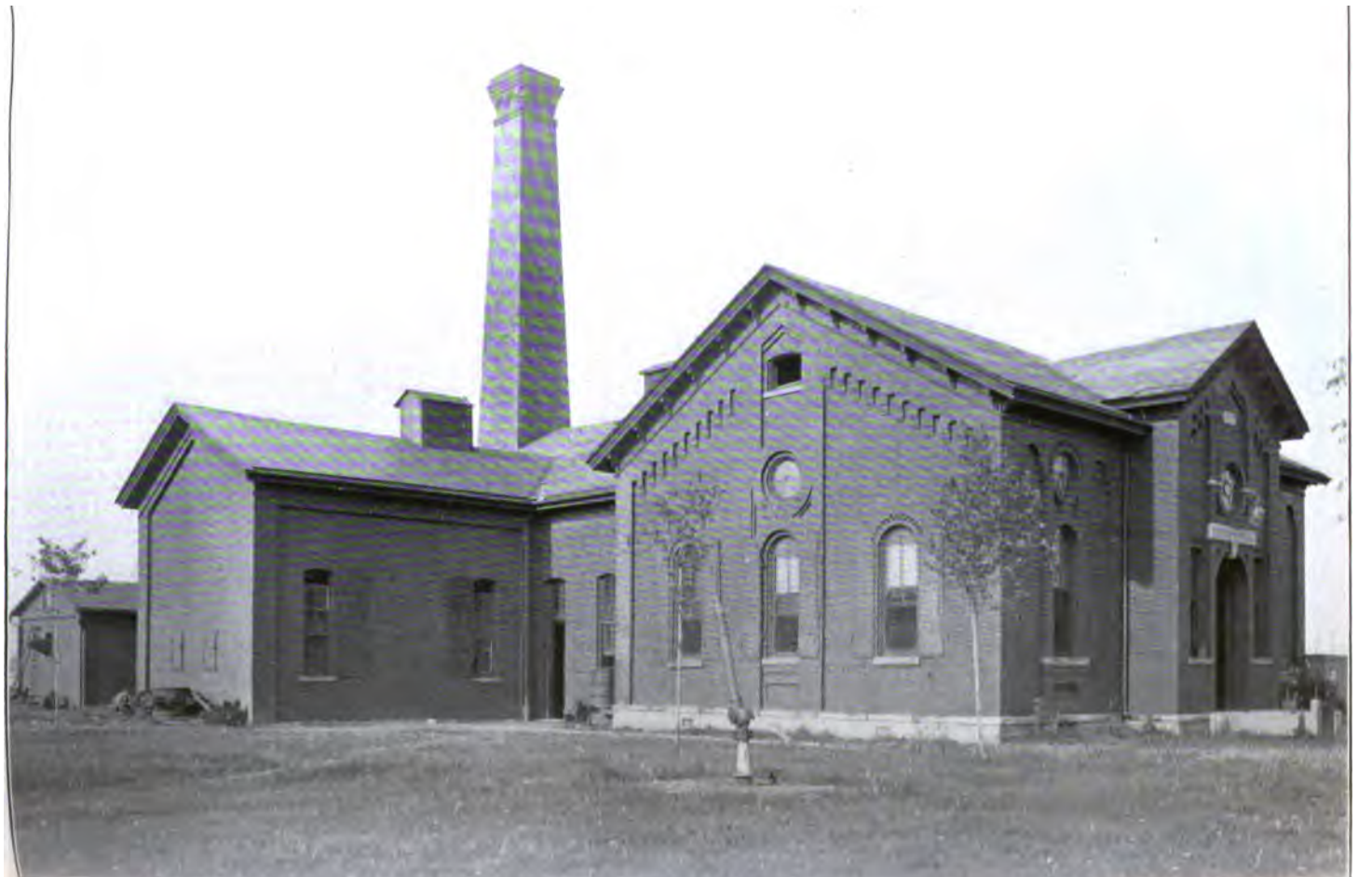
	4 in.	3 in.	1 in.	¾ in.	⅝ in.	½ in.	⅜ in.	Total
Union Rotary	1	1			3			5
Union Rotary "A"					4			4
Columbia					2			2
Crown			2	1			2	5
Empire				1				1
Worthington					1			1
Thomson				2	2			4
Thomson Bee						3		3
Thomson Lambert					1			1
Trident					4			4
Totals	1	1	2	4	17	3	2	30

Meters Set in 1903.

	1½ in.	1 in.	¾ in.	⅝ in	½ in.	Total
Union Rotary				3		3
Union Rotary "A"				5		5
Columbia				1		1
Crown		3	1		1	5
Empire			1		3	4
Nash "A"				5		5
Worthington	1			1		2
Worthington Disc				5		5
Hersey		2		2		4
Hersey Disc "F"				29		29
Thomson			1	3		4
Thomson Bee					1	1
Thomson Lambert				11		11
Trident				16		16
Keystone				12		12
Totals	1	5	3	93	5	107

Meters in Service December 31st, 1903.

	8 in.	6 in.	4 in.	3 in.	2 in.	1½ in.	1 in.	¾ in.	⅝ in.	½ in.	⅜ in.	Total
Union Rotary	1	1	3	14	6	4	3	1	41			74
Union Rotary "A"						1			51			52
Union Duplex									18			18
Columbia									28			28
Crown							90	34		28	40	122
Empire							3	31		20		54
Empire "A"									11			11
Empire "AA"									39			39
Nash									31			31
Nash "A"									41			41
Worthington					6	4			14			24
Worthington Disc									5			5
Hersey							2	5	25			32
Hersey Disc									41			41
Hersey Disc "F"									39			39
Thomson							1	1	102			104
Thomson Bee									18	70		88
Thomson Lambert									46			46
Trident									138			138
Westinghouse									4			4
Pittsburg Disc									6			6
Keystone									18			18
Total	1	1	3	14	12	9	29	72	716	118	40	1015



Meters in Stock December 31st, 1903.

	4 in.	3 in.	2 in.	1½ in.	1 in.	¾ in.	⅝ in.	½ in.	⅜ in.	Total
Union Rotary	3	7	....	....	....	....	....	....	..	10
Union Rotary "A"	....	....	....	....	....	....	2	....	....	2
Union Duplex	....	....	..	....	....	....	4	....	....	4
Columbia	....	....	....	....	....	..	1	....	....	1
Crown	....	....	....	1	5	..	....	..	2	8
Empire	....	....	....	....	3	4	....	5	....	12
Gem	....	....	1	....	....	....	....	....	....	1
Nash "A A X"	....	....	....	....	....	....	6	....	....	6
Worthington	....	....	1	2	....	....	2	....	....	5
Hersey	....	....	....	....	....	....	1	..	....	1
Hersey Disc "F"	....	....	....	....	....	....	1	....	....	1
Thomson	....	....	....	....	1	1	....	....	....	2
Thomson Bee	....	..	....	..	..	....	....	2	....	2
Trident	....	....	..	..	..	....	3	....	....	3
Westinghouse	....	....	....	....	..	..	2	....	..	2
Total	3	7	2	3	9	5	22	7	2	60

The amount expended during year on account of the extension of the meter system was:

78 new meters cost	$ 661.84	
Setting meters, labor and material	135.66	
		$ 797.50

Total cost of meter system to December 31st, 1903:

1015 meters in service cost	$ 17,562.42	
60 meters in stock cost	2,299.51	
Meter fittings, etc., in stock	161.58	
Labor, etc., on 143 meters removed	1,075.07	
3 motor indicators (taken out)	33.35	
		$ 21,131.93

PUMPING STATION.

During the months of December, 1902, and January, 1903, the Gaskill engines and pumps were thoroughly overhauled, the steam cylinders bored out and fitted with new pistons and rings; the pump plungers turned and the pump cylinders equipped with Chase patent adjustable packing rings, and such minor repairs made as were found necessary.

The amount expended during the year for operating the pumping engines was:

For engineer's and firemen's wages	$ 3,770.96	
For fuel	3,979.87	
For oil, packing and engineer's supplies	311.26	
For repairs on engines and boilers	1,786.69	
Total		$ 9,848.78

The net cost of operating the pumping engines was $9,813.23 as follows:

For engineer's and firemen's wages	$ 3,770.96	
For fuel consumed	3,939.89	
For oil, packing and engineer's supplies used	315.69	
For repairs on engines and boilers	1,786.69	
Total		$ 9,813.23

The quantity of fuel at the pumping station January 1st, 1903, was:

100,000 pounds Wenona Mine slack cost	$ 67.50	
50,000 pounds Ohio lump cost	66.25	
2½ cords wood cost	3.32	
		$ 137.07

Fuel delivered at pumping station during the year:

309,300 pounds Wenona, run of mine, cost	$ 347.97	
4,237,600 pounds Wenona slack, cost	3,390.08	
Unloading coal, cost	226.82	
6 cords wood, cost	15.00	
		$ 3,979.87

Fuel on hand December 31st, 1903:

78,800 pounds, run of mine, cost	$ 92.58	
87,500 pounds slack, cost	74.47	
4 cords wood, cost	10.00	
		$ 177.05

Fuel consumed during the year:

4,530,600 pounds coal, cost	$ 3,931.57	
4½ cords wood, cost	8.32	
		$ 3,939.89
Average cost of coal per ton (2,000 lbs.) in bins	$ 1.74	
The value of oil, packing and engineer's supplies on hand January 1st, 1903	125.76	
Delivered at pumping station during the year	311.26	
		$ 437.02
On hand December 31st, 1903		121.33
Used during the year		$ 315.69

The Gaskill engines and pumps were run 8,689 hours and 35 minutes, and pumped 1,061,134,234 gallons.

The Qaudruplex engines and pumps were run 581 hours and 15 minutes, and pumped 41,741,480 gallons.

The H. P. engine and rotary pumps were run 18 hours and 50 minutes, and pumped 1,337,067 gallons.

The total quantity of water pumped during the year, as indicated by the revolutions of the pumps, without any allowance for slip, was 1,104,212,781 gallons. Of this quantity, 1,-

087,608,427 gallons were pumped against a domestic pressure of 40 lbs. per square inch, and 16,604,309 gallons were pumped against a fire pressure of from 70 lbs. to 90 lbs. per square inch at the pressure gauge in the pumping station. The average head against which all of the water was pumped, including lift of suction, was 113 feet.

The cost of pumping, based on net cost of operating pumping engines, $9,813.23, was:

Per million gallons pumped	$ 8.89
Per million gallons raised 100 feet	7.86

The cost of fuel consumed, $3,939.89, was:

Per million gallons pumped	$ 3.57
Per million gallons raised 100 feet	3.16

The number of gallons pumped per pound of coal was 244.

WATER PUMPED, 1903.

Month	Gaskill Engines			Quadruplex Engines			H. P. Engines and Rotary Pumps			Totals		Fires					
	Hours Run	Revolutions	Gallons Pumped	Hours Run	Revolutions	Gallons Pumped	Hours Run	Revolutions	Gallons Pumped	Gallons Pumped	Daily Average	No. Alarms	Hours Run	Highest Pressure	Lowest Pressure	Average Pressure	Gallons Pumped
January	735.15	*1,015,458	82 021,446	404.35	478 833	26,335,815	3.35	16,310	277,270	108,634,531	3,504,340	10	8.00	80	70	74	1,601,610
February ..	669.50	735,838	86,828,884	2.10	5,334	293,370	....	.....	.....	87,122,254	3.111,509	12	4.58	80	70	71	876,386
March.....	742.10	771.084	90,987,912	1.50	5,232	287,760	.....	.....	.....	91,275,672	2.944,376	14	4.51	70	70	70	789,538
April.....	703.55	*688,536	80,418,534	26 05	50,101	2,755,555	4 00	16,842	286.314	83,460,403	2,782,013	16	6 01	70	70	70	889,838
May	743.00	767,472	90,561,696	4.40	8,474	466,070	.....	.....	.....	91.027,766	2,936,380	17	16.41	80	70	74	3,215,698
June	695.20	804,052	94.878,136	24.30	58,592	3,222,560	4.30	18,678	317.526	98,418.222	3,280,607	6	1.27	70	70	70	242,136
July.	735.25	*879,760	99,568,626	109.55	130,561	7,180.855	6.45	26,821	455.957	107,005,438	3,451.788	27	17.23	90	70	74	3,950,149
August . ..	740.10	742,993	87,673.174	3.50	11,073	609,015	.....	.....	.....	. 88,282,189	2,847,813	14	5.57	70	70	70	1.111,324
September.	716.50	732,307	86,412,226	3.10	8,871	487,905	.....	.....	.. ..	86,900,131	2,896,671	8	2.46	70	70	70	437,780
October	743 30	756,710	89,291,780	.30	1,865	102,575	.....	. ....	.... .	89,394,355	2,883,689	12	8.14	70	70	70	1,319,358
November .	730 00	690,070	81,428,260	.....	.. ...	.....	...	.....	.....	81,428,260	2,714,275	19	8.48	70	70	70	1,352,634
December ...	744.00	773,420	91,263,560	.....	.....	.....	.....	. ....	.....	91,263,560	2,943,986	13	4.59	70	70	70	817,858
Totals.	8,689 35	*9,357,700	1,061,134,234	581.15	758,990	41 741,480	18 50	78,651	1.337,067	1,104,212,781	3,025,240	168	90.05	90	70	72	16,604,309

*In January, the right Gaskill Engine and Pump were run 396 hours with the left engine and pump shut down, making 640,722 revolutions.
*In April the right Gaskill pump was run 10 hours with the left pump disconnected, making 14,046 revolutions.
*In July the right Gaskill engine and pump were run 48¼ hours with the left engine and pump shut down, making 75,306 revolutions.
*730,074 revolutions of the Gaskill engines at ¾ capacity
Greatest quantity of water pumped in one day, 4,177,938 gallons, January 10th
Least quantity of water pumped in one day 2,481,304 gallons, November 22nd.
Daily average for year, 3,025,240 gallons

The total quantity of water pumped each year since the works commenced supplying water, has been as follows:

1873.....	142,477,725 gallons	1889.....	944,472,747 gallons
1874.....	294,714,798 "	1890.....	988,771,453 "
1875.....	416,756,579 "	1891.....	1,014,475,024 "
1876.....	518,197,129 "	1892.....	962,953,662 "
1877.....	538,847,186 "	1893.....	1,044,256,236 "
1878.....	530,197,397 "	1894.....	1,024,735,621 "
1879.....	672,344,128 "	1895.....	1,122,363,460 "
1880.....	827,067,372 "	1896.....	1,009,523,471 "
1881.....	944,382,043 "	1897.....	914,545,290 "
1882.....	*775,642,466 "	1898.....	1,038,794,253 "
1883.....	773,942,702 "	1899.....	1,118,599,631 "
1884.....	831,867,463 "	1900.....	1,142,339,229 "
1885.....	836,970,016 "	1901.....	1,082,691,511 "
1886.....	779,761,852 "	1902.....	1,069,661,847 "
1887.....	827,195,000 "	1903.....	1,104,212,781 "
1888.....	872,990,164 "		

*Commenced metering in 1881.

PUMPING PLANT.

Boilers.

One boiler (No. 1), horizontal tubular (installed in 1872), 16 feet long, 66 inches in diameter, containing 105 tubes 16 feet long and 2¾ inches interior diameter. (This boiler is not used).

Two boilers (Nos. 4 and 5), horizontal tubular (installed in 1893), 16 feet long, 60 inches in diameter, each containing 48 tubes 16 feet long and 3¾ inches interior diameter.

One boiler (No. 3), horizontal tubular (installed in 1898), 16 feet long, 66 inches in diameter, containing 64 tubes 16 feet long and 3¾ inches interior diameter.

One boiler (No. 2), horizontal tubular (installed in 1899), 16 feet long, 66 inches in diameter, containing 64 tubes 16 feet long and 3¾ inches interior diameter.

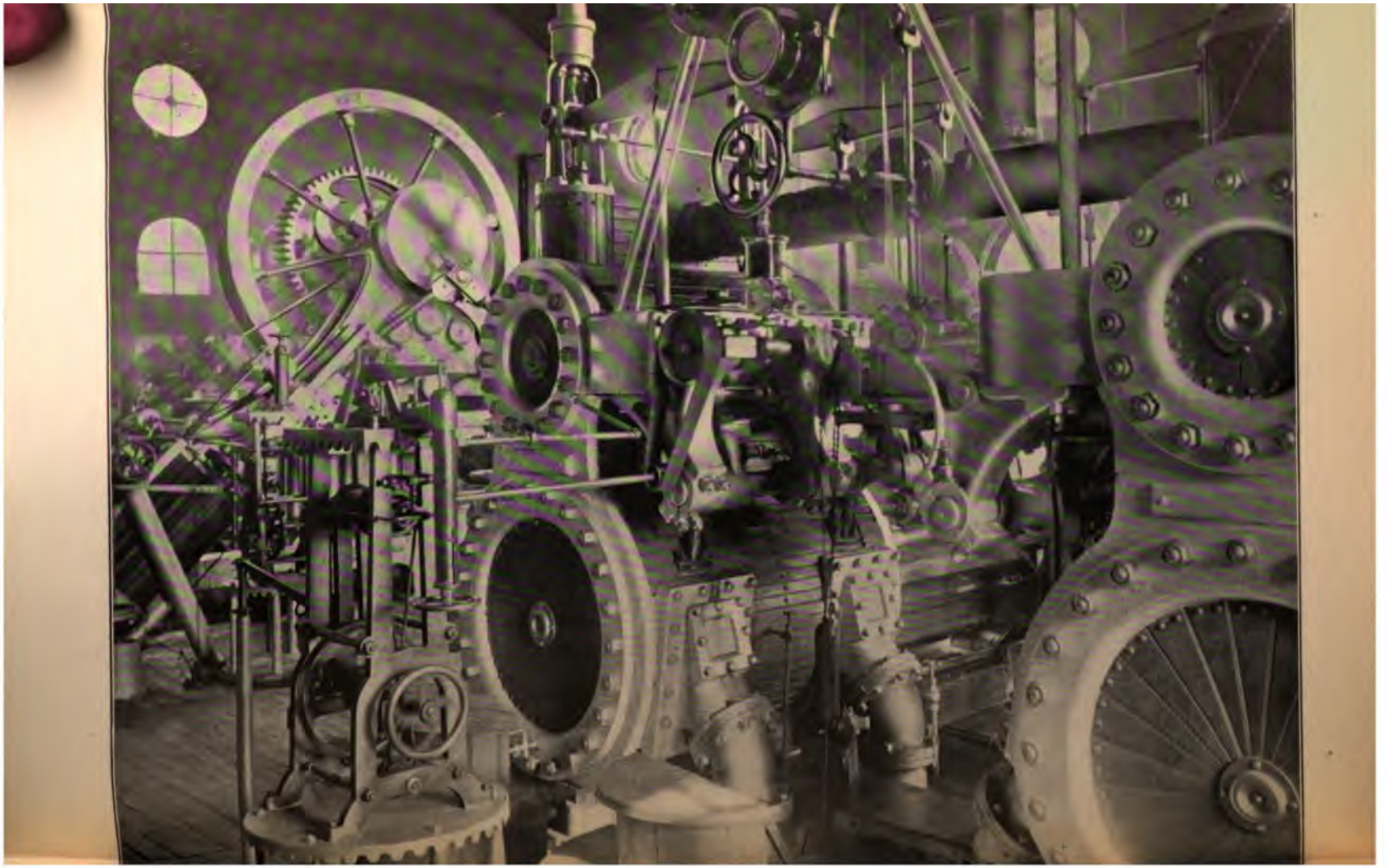
The area of grate surface under each boiler is:

No. 1, 27½ square feet; No. 4 and 5, each 22½ square feet: Nos. 2 and 3, each 24¾ square feet.

Heating surface: No. 1, (½ shell 138 24-100 square feet, entire tubes 1209 51-100 square feet), 1347 75-100 square feet.

Nos. 4 and 5, each (½ shell 125 66-100 square feet, entire tubes 753 98-100 square feet), 879 64-100 square feet.

Nos. 2 and 3, each (½ shell 138 24-100 square feet, entire tubes 1,005 31-100 square feet), 1,143 55-100 square feet.



Engines and Pumps.

One Gaskill horizontal compound condensing crank and fly-wheel pumping engine (installed in 1886); maximum capacity, 5,000,000 gallons in 24 hours.

One Holly quadruplex, compound condensing crank and fly-wheel pumping engine (installed in 1872); maximum capacity, 3,000,000 gallons in 24 hours.

One horizontal high pressure piston engine (installed in 1879), driving, through gears, two No. 10 Holly rotary pumps (installed in 1872); maximum capacity, 2,500,000 gallons in 24 hours.

Capacity of Gaskill pumps per revolution, 117 gallons.

Capacity of Quadruplex pumps per revolution, 55 gallons.

Capacity of Rotary pumps (2) per revolution, 17 gallons.

SERVICE CONNECTIONS AND SERVICES.

The number of service connections connected with the main pipes during the year was 180, as follows:

	Branches	Corporation Stops				Total
	4"	1"	¾"	⅝"	½"	
With Cast Iron Mains	1	2	18	53	63	137
With Wyckoff Mains			5	20	18	43
Totals	1	2	23	73	81	180

95 of these connections were made to replace connections taken out or abandoned, and 85 were for supplying new service.

The number of service connections taken out during the year was 87, as follows:

	Corporation Stops.				Total
	1"	¾"	⅝"	½"	
In Cast Iron Mains			1		1
In Wyckoff Mains	2	26	29	29	86
Total	2	26	30	29	87

The total number of service connections in the main pipe December 31st, 1903, is 2,269, as follows:

	Branches					Corporation Stops.							Total.
	8"	6"	4"	3"	2"	2"	1¼"	1"	¾"	⅝"	½"	⅜"	
In Cast Iron Mains.....	2	6	17	3	4	2	3	86	151	410	397	5	1086
In Wyckoff Mains.....	....	1	9	1	1	.. .	...	89	227	363	486	6	1183
Totals	2	7	26	4	5	2	3	175	378	773	883	11	2269

Of these connections 99 have been abandoned but not taken out, as follows:

	Branches.			Corporation Stops.						Total.
	6"	4"	3"	1¼"	1"	¾"	⅝"	½"	⅜"	
In Cast Iron Mains.....	1	1	1	1	8	12	6	15	4	49
In Wyckoff Mains.....	...	2	...	...	9	12	8	17	2	50
Total.....	1	3	1	1	17	24	14	32	6	99

Total number of service connections with service connected, 2,170.

Total number of separate services supplied, 2,408.

Number of services open December 31st, 1903. 1,820.

Number of services shut off, 588.

GENERAL MAINTENANCE AND REPAIRS.

The number of leaks in the main pipes of the system was 84, of which 83 were in Wyckoff mains and 1 in cast iron mains. The one leak in the cast iron mains was in a lead joint, caused by the lead blowing out, and was easily repaired by re-caulking the joint. Of the leaks in the Wyckoff mains, 19 were burst pipe, requiring the placing of new sections, 5 were knot-holes, and 59 were leaks in joints, repaired by plugging.

During the months of February and March, 26 fire hydrants were found frozen and at once placed in working order by employees of this department. In no case was the fire department delayed by frozen hydrants.

The amount expended during the year for repairs on main distribution was $823.81, as follows:

Labor repairing leaks in Wyckoff mains	$ 330.87	
Pipe for repairing leaks in Wyckoff mains	109.47	
Labor repairing leak in cast iron main	6.50	
Labor examining, testing, blowing off hydrants	100.25	
Labor repairing hydrants	90.38	
Shop repairs on hydrants	14.05	
Parts of hydrants from manufacturer for repairs	99.08	
Painting hydrants	20.18	
Repairing valves and valve boxes	33.38	
Moving valve at Cass Ave. and Harrison St	10.25	
Tools and repairing tools	9.40	
		$ 823.81

The number of service pipes repaired by employees of this department was 18, of which 14 were private mains laid with 2-inch Wyckoff pipe, 2 were lead services, 1 a wrought-iron service and 1 a shut-off valve on a large service.

The number of services shut off during the year was 346, of which 48 were closed for non-payment of rates, 16 for leaks, 141 premises found vacant, and 141 at request of consumer. The number of services opened by employees of the department was 347.

The amount expended for the repair and care of services was $553.49, as follows:

Labor repairing private mains	$ 84.06	
Pipe for repairing private mains	25.35	
Repairing lead and iron services and shut-offs	12.58	
Changing service connections	8.25	
Examining services and notifying consumer	157.50	
Turning on and off water	265.75	
		$ 553.49

The number of water meters which have required repairs was 287, of which 284 were repaired by the inspector with parts received from the manufacturers, and 3 were sent to the makers for repairs. 305 meters have been tested during the year.

The amount expended for the repair and care of water meters was $1,138.09 as follows:

Reading meters	$ 414.75	
Labor repairing and cleaning meters	443.00	
Parts of meters for repairs	113.66	
Repairs on meters sent to makers	18.85	
Changing and taking out meters	25.94	
Repairing meter boxes, sewering and protecting	115.55	
Tools and repairing tools	6.34	
		$ 1,138.09

The total amount expended during the year for maintenance and repairs, not including cost of operating pumping engines and interest on bonds, was $6,374.31, as follows:

Office salaries	$ 2,600.00	
Office expenses	298.40	
Repairs on main distribution	823.81	
Repairs and care of services	353.49	
Repairs and care of water meters	1,138.09	
Service connections	159.08	
Repairs and care of inlet works at bay	533.95	
Repairs and care of inlet from river	100.00	
Repairs to engine house	134.32	
Repairs and care of engine house grounds	33.17	
		$ 6,374.31

The entire cost of maintaining and operating the plant, including the interest on the bonded debt, which was paid by tax levy, was $36,413.09.

The department is entitled to credits as follows:

Collections from water rates	$ 25,222.50
Received from miscellaneous sources not on construction account	418.80

Public uses from which no revenue is received:

443 public fire hydrants @ $45 each	$ 19,935.00	
15 public watering troughs @ $150.00 each	2,250.00	
8 public drinking fountains @ $25 each	200.00	
4 ornamental fountains @ $50 each	200.00	
City Hall	200.00	
City electric light plant	226.50	
6 fire department houses @ $25 each	150.00	
Street sprinkling	500.00	
Sprinkling public parks	150.00	
Flushing public sewers	2,000.00	
		$ 25,821.50

Uses supplied free under orders of the Common Council:

One Mission	$ 14.00	
Old Ladies Home	16.00	
Childrens Home	55.00	
		$ 85.00
		$ 51,547.80

All of which is respectfully submitted.

E. L. DUNBAR,

Superintendent and Secretary.

SUMMARY OF STATISTICS.

For the Year Ending December 31st, 1903.

(In form recommended by the New England Water Works Association.)

BAY CITY WATER WORKS.

Bay City, Bay County, Michigan.

General Statistics.

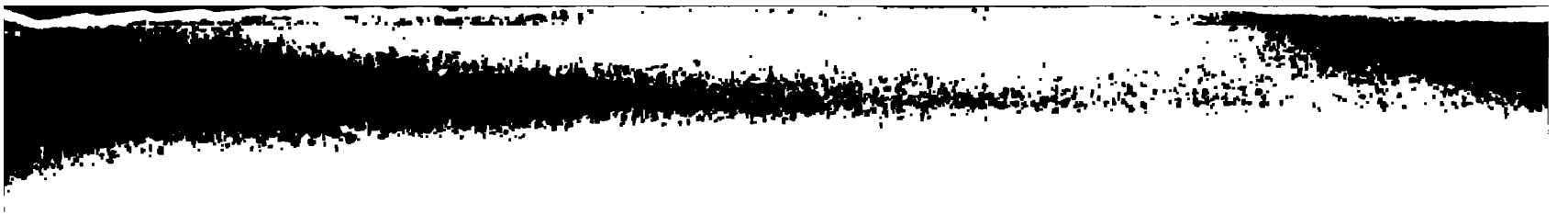
Population by census of 1900, 27,628.
Date of construction, 1872.
By whom owned, Bay City.
Source of supply, Saginaw Bay.
Mode of supply, direct pumping.

Pumping Statistics.

1. Builders of pumping machinery, Holly Manf'g. Co.
2. Description of fuel used.
   - **a.** Kind, coal.
   - **b.** Brand of coal, bituminous slack.
   - **c.** Average price per gross ton, delivered, $2.02.
   - **d.** Percentage of ash, 23 per cent.
   - **e.** Wood, price per cord, $1.85.
3. Coal consumed for year, 4,530,600 pounds.
4. Pounds of wood consumed, divided by 3—equivalent amount of coal, 3,000 pounds.
5. Total equivalent coal consumed for year, 4,533,600 pounds.
6. Total pumpage for year, 1,104,212,781 gallons (without any allowance for slip).
8. Average dynamic head against which pumps work, 113 feet.
9. Number of gallons pumped per pounds of equivalent coal, 244.
10. Duty $= \frac{1,104,212,781 \times 8.34 \times 100 \times 113}{4,533,600} = 22,953,772$.

Cost of pumping figured on pumping station expenses, $9,813.23.

11. Per million gallons pumped, $8.89.
12. Per million gallons raised one foot, $.0786.







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Thirty-third Annual Report

of the

Water Department

Bay City, Michigan



December thirty-first, nineteen hundred four

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THIRTY-THIRD

ANNUAL REPORT

OF THE

Water Department

OF

BAY CITY, MICHIGAN

December 31st, 1904

BAY CITY, MICHIGAN
PRESS OF C. & J. GREGORY
1905

Water Department

January 1st, 1905

COMMISSIONERS

WALTER S. COUSINS, President
(Term Expires Sept. 6th, 1906)

HOMER E. BUCK
(Term Expires Sept. 6th, 1905)

ARTHUR H. INGRAHAM
(Term Expires Sept. 6th, 1907)

ARTHUR F. BROOKMAN
(Term Expires Sept. 6th, 1908)

SAMUEL MEISTER
(Term Expires Sept. 6th, 1909)

BENJAMIN F. RAY
(Term Expires Sept. 6th, 1910)

OFFICERS AND EMPLOYEES.

E. L. Dunbar ..... Chief Eng'r., Supt. and Secretary
T. A. Delzell ..... Assistant Secretary
F. H. Collins ..... Inspector
Richard D. Smith ..... Reservoir Keeper
A. B. Verity ..... First Engineer
Jas. E. Darling ..... Second Engineer
Albert D. Case ..... Fireman
Daniel Woodbury ..... Fireman

Members of Board of Commissioners of Water Works from Organization of Board

The first board was appointed by the Common Council September 6th, 1871.

Michael Daily—Resigned May 13th, 1872.

Hon. James Shearer—Reappointed Sept. 8th, 1873; resigned Oct. 20th, 1873.

William Westover—Reappointed March 29th, 1875, and Oct. 20th, 1879; resigned Sept. 4th, 1883.

John McDowell—Died May 11th, 1872.

Henry M. Bradley—Reappointed February 4th, 1878; resigned May 3rd, 1880.

Hon. Andrew Walton—Appointed in place of Michael Daily May 27th, 1872; reappointed Dec. 9th, 1872, Feby. 4th, 1878, Jan. 22nd, 1883, Oct. 10th, 1887, Oct. 15th, 1894; died July 18th, 1899.

William Smalley—Appointed in place of John McDowell May 27th, 1872; reappointed Feby. 4th, 1878, Dec. 13th, 1880; served until Sept. 28th, 1885.

In 1873 the number of Commissioners was increased to seven.

Andrew J. Miller—Appointed Aug. 4th, 1873, served until Oct. 13th, 1874.

Thomas H. McGraw—Appointed Aug. 4th, 1873; resigned Sept. 14th, 1874.

Thomas Cranage—Appointed in place of Hon. James Shearer Nov. 3rd, 1873; reappointed Sept. 2nd, 1878, served until Sept. 17th, 1883.

William C. McClure—Appointed in place of Thomas H. McGraw Sept. 21st, 1874; reappointed Nov. 8th, 1875; resigned March 24th, 1879.

James Clarke—Appointed in place of Andrew J. Miller, Oct. 13th, 1874; served until Oct. 20th, 1879.

George C. Meyers—Appointed in place of William C. McClure May 5th, 1879; reappointed, Dec. 13th, 1880, Sept. 28th, 1885; served until Sept. 8th, 1890.

William Daglish—Appointed in place of James Clarke, Oct. 20th, 1879; resigned Oct. 24th, 1881.

Charles E. Young—Appointed in place of Henry M. Bradley June 21st, 1880; reappointed Sept. 5th, 1881; resigned Jan. 4th, 1886.

Duncan McGregor—Appointed in place of William Daglish Oct. 31st, 1881; reappointed Sept. 28th, 1885, August 26th, 1889, August 29th, 1892; served until Oct. 16th, 1899.

G. Henry Shearer—Appointed in place of Thomas Cranage Sept. 17th, 1883; reappointed Sept. 24th, 1888, May 11th, 1896; served until Feb. 23rd, 1903.

Benjamin F. Ray—Appointed in place of William Westover Sept. 17th, 1883; reappointed Sept. 1st, 1884, August 26th, 1889, Oct. 5th, 1896 and Oct. 12th, 1903. (Now a member of board).

John D. McKinnon—Appointed in place of William Smalley Sept. 28th, 1885; served until Sept. 8th, 1890.

Andrew Van-den-Brooks—Appointed in place of Charles E. Young Nov. 22nd, 1886; resigned March 21st, 1887.

Louis Moritz—Appointed in place of Andrew Van-den-brooks, May 9th, 1887; reappointed Sept. 7th, 1891; removed from city 1898.

Selwyn Eddy—Appointed in place of John D. McKinnon Sept. 8th, 1890; resigned April 7th, 1891.

Fremont J. Tromble—Appointed in place of George C. Meyers Sept. 8th, 1890; reappointed Sept. 11th, 1893; served until April 29th, 1901.

Sanford V. Wilkin—Appointed in place of Selwyn Eddy April 27th, 1891; served until Oct. 16th, 1899.

Arthur F. Brookman—Appointed in place of Hon. Andrew Walton Oct. 16th, 1899; reappointed Sept. 23rd, 1901. (Now a member of board).

Robert E. Bousfield—Appointed in place of Sanford V. Wilkin Oct. 16th, 1899; removed from city Oct., 1903.

Homer E. Buck—Appointed in place of Louis Moritz Oct. 16th, 1899. (Now a member of board).

Walter S. Cousins—Appointed in place of Duncan McGregor Oct. 16th, 1899. (Now a member of board).

Arthur H. Ingraham—Appointed in place of Fremont J. Tromble April 29th, 1901. (Now a member of board).

Samuel Meister—Appointed in place of G. Henry Shearer Feb. 23rd, 1903. (Now a member of board.)

PRESIDENTS OF BOARD.

Hon. James Shearer—Sept. 13th, 1871, to Oct. 20th, 1873.

William Westover—Nov. 7th, 1873, to Sept. 4th, 1883.

Hon. Andrew Walton—Sept. 25th, 1883, to Oct. 30th, 1896.

Sanford V. Wilkin—Oct. 30th, 1896, to Oct. 16th, 1899.

G. Henry Shearer—Oct. 31st, 1899, to Feb. 23rd, 1903.

Walter S. Cousins—Feb. 28th, 1903. (Now president).

SECRETARIES.

Hon. James Shearer—President—Acted as secretary from Sept. 13th, 1871, to Jan. 19th, 1872.

E. L. Dunbar—Appointed chief engineer and superintendent of water works and secretary of board Jan. 2nd, 1872; approved by Common Council Jan. 15th, 1872; continued in office to the present time.

To the Honorable, the Mayor and Common Council of Bay City, Michigan:

Gentlemen: The Board of Commissioners of Water Works respectfully submit for your information the thirty-third annual report of the Water Department, showing the operations of the department for the year ending December 31st, 1904:

WALTER S. COUSINS, President.
HOMER E. BUCK,
ARTHUR H. INGRAHAM.
ARTHUR F. BROOKMAN,
SAMUEL MEISTER,
BENJAMIN F. RAY,
Commissioners of Water Works.

Superintendent's Report

To the Honorable Board of Commissioners of Water Works of Bay City, Michigan:

Gentlemen: I have the honor to submit my thirty-third annual report, showing the operations of the Water Department for the year ending December 31st, 1904.

The total receipts of the department for the year were $27,143.18, an increase of $982.73 over the year 1903. The receipts from water rates were $26,004.39, an increase of $781.89 over the preceding year. The total amount charged on the roll of 1904 for water supplied to consumers was $26,966.49, an increase of $1,230.30 over the amount charged on roll of 1903.

The expenditures of the department were $27,034.83; of which $15,554.33 was for maintenance, operating expenses and repairs, and $11,480.50 was for construction and replacing Wyckoff mains with cast iron. The expenditures for maintenance, operating expenses and repairs were $668.76 less than for the year 1903.

About 2 1-10 miles of cast iron distributing mains were laid during the year, of which 1 6-10 miles were replacing Wyckoff mains and 5-10 miles were for extensions on street where no pipe had been previously laid.

There are still 21 1-10 miles of Wyckoff mains in service, of which 6 9-10 miles were laid previous to 1883.

The number of leaks in Wyckoff mains during the year was 87, of which 73 were on this 6 9-10 miles of old pipe. The number of leaks during the year on the 27 4-10 miles of cast iron in service was 5.

The length of time the supply from the river has been called upon to help out the supply has been considerably more than in 1903, but the quantity of water taken from that source has been but little more than for that year, being a little less than 11,000,000 gallons, or about one per cent of the water pumped.

The total quantity of water pumped during the year was 1,091,013,061 gallons, which is about 13 million gallons less

than was pumped in 1903. In every case where a line of old Wyckoff mains has been replaced, the excavation has disclosed a large amount of leakage which was making its way into the sewers without appearing at the surface of the ground. The cost of repairing the leaks which have made their appearance at the surface has been no small item as appears in this report but the undiscovered leaks are a constant drain upon the works, the extent of which cannot be definitely determined, but it is, without doubt, of such magnitude as to warrant the immediate renewal of all of the Wyckoff mains laid previous to 1883.

There has been no opportunity during the year to examine the pipes at points where electrolysis is most likely to be affecting them, and no breaks have yet occurred which can be attributed to this cause, but it is known that there is an amonut of electric current passing along the water mains in some parts of the city which is dangerous to the continued life of the pipes and excavation should be made to the pipes at a few points and a careful examination made of their condition.

The regulations of the department now in force require consumers to bear the expense of laying their service pipes from the main, without regard to its location. On wide streets where there is but one main pipe and that located near one side of the street, the cost to the consumer on the opposite side of the street is materially more than to the consumer on the same side of the street as the main. The only way to remedy this injustice is for the city to put in the service to the stop box at the side walk, charging a uniform price equal to the cost of laying the service from the center of the street. This would render it necessary for the city to employ a plumber and keep a stock of lead pipe, stop cocks and stop boxes on hand.

The use of the public fire hydrants by unauthorized persons, has been the source of much trouble and considerable expense to this department. The rules now laid down by ordinance are sufficient to protect the works from this abuse, but they cannot well be enforced without the co-operation of the other departments of the city government.

FINANCIAL

RECEIPTS.

The receipts of the department during the year 1904 were as follows:

From water rates, roll of 1893	$ 4 50	
From water rates, roll of 1896	11 20	
From water rates, roll of 1897	9 60	
From water rates, roll of 1898	14 92	
From water rates, roll of 1899	16 15	
From water rates, roll of 1901	33 70	
From water rates, roll of 1902	166 30	
From water rates, roll of 1903	1,230 35	
From water rates, roll of 1904	24,517 77	
Total from water rates		$26,004 39
From service connections	$ 310 50	
From plumbers licenses	40 00	
From repairs on main distribution	1 25	
From repairs and care of services	5 00	
Total miscellaneous (maintenance)		$ 356 75
From water meter account	$ 10 35	
From Wyckoff pipe account	733 55	
From cast iron pipe account	19 34	
From valve account	17 00	
From laying pipe account	1 80	
Total miscellaneous (construction)		$ 782 04
Total receipts		$27,143 18

The receipts by months were:

January	$ 1,151 74	
February	812 43	
March	1,267 86	
April	2,163 48	
May	847 06	
June	1,214 43	
July	2,535 18	
August	1,032 44	
September	2,261 72	
October	1,906 63	
November	1,088 69	
December	10,861 52	
Total		$27,143 18

EXPENDITURES.

The expenditures of the department during the year 1904 were:

MAINTENANCE ACCOUNTS.

Office department:

Salaries	$ 2,600 00	
Office expenses	284 44	

Street and service department:

Repairs on main distribution	1,320 67	
Repairs and care of services	632 16	
Repairs and care of water meters	1,000 59	
Service connections	169 87	

Inlet department:

Repairs and care of inlet works at bay	518 21	
Repairs and care of inlet from river	68 80	

Pumping department:

Salaries	3,770 68	
Fuel	4,324 80	
Oil, packing and supplies	391 03	
Repairs to engines and boilers	374 12	
Repairs to boiler arches	8 52	

Repairs to buildings and grounds:

Repairs to engine house	49 90	
Repairs to engine house grounds	41 04	
Total for maintenance and operating expenses		$15,554 33

CONSTRUCTION ACCOUNTS.

Water meters:

New meters	$ 724 77	
Setting meters	58 44	

Main Distribution:

Cast iron pipe	5,751 73	
Valves and valve boxes	582 83	
Fire hydrants	196 55	
Laying pipe	4,166 18	
Total for construction		$11,480 50
Total expenditures		$27,034 83

The expenditures by months were:

January	$ 1,199 21
February	1,127 19
March	1,281 51
April	6,952 31
May	2,795 57
June	1,993 66
July	3,419 98
August	2,459 00
September	1,440 90
October	1,386 11
November	1,271 43
December	1,707 96
Total	$27,034 83

Account with Water Works Fund:

	Dr.	Cr.
Balance in fund, January 1st, 1904	$ 10,803 01	
Cash collections deposited with City Treasurer	27,143 18	
By Recorder's warrants No. 419 to 430 inclusive		$27,034 83
Balance in fund, December 31st, 1904		10,911 36
	$37,946 19	$37,946 19

Account with City Treasurer as treasurer of board:

To Recorder's warrants No. 419 to 430 inclusive	$ 27,034 83	
By paid Sec'y's orders No. 7091 to 7582 inclusive		$27,034 83
	$27,034 83	$27,034 83

BALANCES FOR 1904.

Ledger	G.		Dr.	Cr.
Folio	40	Water rates, roll of 1904		$24,517 77
"	42	Water rates, roll of 1903		1,230 35
"	43	Water rates, roll of 1902		166 30
"	44	Water rates, roll of 1901		33 70
"	44	Water rates, roll of 1899		16 15
"	45	Water rates, roll of 1898		14 92
"	45	Water rates, roll of 1897		9 50
"	43	Water rates, roll of 1896		11 20
"	45	Water rates, roll of 1893		4 50
"	46	Plumbers' licenses		40 00
"	54	Service connections		140 63
"	66	Wyckoff pipe		733 55

"	48	City water works fund	$ 108 35	
"	49	Office department, salaries	2,600 00	
"	50	Office department, expenses	284 44	
"	70	Street and Service department, repairs on main distribution	1,319 42	
"	56	Street and Service department, repairs and care of services	627 16	
"	69	Street and Service department, repairs and care of water meters	1,000 59	
"	55	Inlet department, repairs and care of inlet works at bay	518 21	
"	57	Inlet department, repairs and care of river inlet	68 80	
"	58	Pumping department, salaries	3,770 68	
"	59	Pumping department, fuel	4,324 30	
"	60	Pumping department, oil, packing and supplies	391 03	
"	61	Pumping department, repairs on engines and boilers	374 12	
"	62	Pumping department, repairs on boiler arches	8 52	
"	63	Repairs to engine house	49 90	
"	64	Repairs and care of engine house grounds	41 04	
"	65	Water meter account, new meters	714 42	
"	65	Water meter account, setting meters	58 44	
"	66	Main distribution, cast iron pipe	5,732 39	
"	66	Main distribution, valves	565 83	
"	67	Main distribution, fire hydrants	196 55	
"	64	Main distribution, laying pipe	4,164 38	
			$26,918 57	$26,918 57

Face of Ledger December 31st, 1904

Ledger	G.		Dr.	Cr.
Folio 2	Construction,	real estate	$ 6,724 83	
" 2	"	dock, tramway and store shed	1,882 63	
" 3	"	engine house, chimney and wells	21,401 42	
" 3	"	engine foundations, boiler foundations and arches	6,777 45	
" 4	"	pumping machinery	59,427 72	
" 4	"	inlet from river	4,799 46	
" 5	"	inlet from bay	84,778 37	
" 5	"	inlet works at bay	24,713 78	
" 6	"	cast iron pipe and branches	147,314 98	
" 6	"	Wyckoff patent pipe	124,724 66	
" 7	"	valves	18,774 72	
" 7	"	fire hydrants	16,790 53	
" 8	"	laying pipe	85,274 42	
" 8	"	buildings at bay	1,299 40	
" 9	"	water meters	21,904 79	
" 9	"	furniture and fixtures	887 96	
" 10	"	implements	1,713 61	
" 10	"	engineering and superintendence	7,856 17	
" 11	"	traveling expenses	306 29	
" 11	"	insurance	29 00	
" 12	"	interest, discounts and commissions	4,224 17	
" 13	Maintenance,	office expenses and salaries.	80,296 87	
" 14	"	repairs and care of hy. drants, valves and pipes	27,966 72	
" 15	"	repairs and care of water meters	11,622 99	
" 16	"	repairs and care of inlet works	40,784 02	
" 17	"	repairs to engine house and grounds	4,595 43	
" 18	"	repairs to dock	13 38	
" 19	"	interest (on bills payable)	3,709 84	
" 20	"	implements	1,129 37	
" 21	"	engineer's and firemen's wages	113,812 92	

"	22	"	fuel	90,521 44	
"	23	"	oil, packing and supplies	11,505 82	
"	24	"	repairs to pumping machinery	11,995 83	
"	25	"	repairs to boiler arches	1,841 04	
"	26	"	repairs to engine foundations	51 46	
"	31	City water works fund		10,911 36	
"	1	Bay City bonds ($452,000)			$443,045 87
"	1	Water assessments, frontage on pipe			736 07
"	27	Service connections			4,323 51
"	28	Plumbers' licenses			1,135 20
"	29	Rents, dockage, etc.			2,627 33
"	30	Water rates			600,496 37
				$1,052,364 35	$1,052,364 35

WATER RATES.

The total amount charged on roll of 1904 for water supplied was $26,966.49, as follows:

For water supplied at fixed rates	$ 9,593 89	
For water supplied through meters	17,372 60	
		$26,966 49

The amount collected on roll of 1904 was:

From fixed rates	$ 8,874 02	
From metered water	15,643 75	
		$24,517 77

The amounts uncollected on roll of 1904 are:

From fixed rates	719 87	
From metered water	1,728 85	
		$ 2,448 72

The amounts collected during the year from previous years' rolls were:

From fixed rates	$ 504 73	
From metered water	981 89	
		$ 1,486 62

The total amount collected during the year from water rates on all rolls was $26,004.39, as follows:

From fixed rates, domestic	$ 8,970 16	
From fixed rates, manufacturing	403 59	
From metered water, domestic	11,646 94	
From metered water, manufacturing	4,978 70	
		$26,004 39

The total amount collected and uncollected on each year's roll since the works commenced supplying water has been as follows:

YEAR'S ROLL	Collected	Uncollected	Total on Roll
1873 January 1st to April 30th	$ 728 82	$	$ 728 82
1873 4, May 1st, 1873, to April 30th, 1874	5,440 80	1 60	5,442 40
1874-5, May 1st, 1874, to April 30th, 1875	6,908 16	44 85	6,953 01
1875 May 1st to December 31st	7,269 55	28 46	7,298 01
1876	9,571 26	82 73	9,653 99
1877	9,604 26	134 19	9,738 45
1878	10,078 15	324 71	10,402 86
1879	11,708 97	136 07	11,845 04
1880	13,155 74	120 25	13,275 99
1881	15,002 61	212 40	15,215 01
1882	17,352 47	158 85	17,511 32
1883	18,717 26	94 84	18,812 10
1884	18,892 52	129 39	19,021 91
1885	19,716 73	269 58	19,986 31
1886	19,356 61	118 74	19,475 35
1887	19,436 25	87 00	19,523 25
1888	21,278 62	120 80	21,399 42
1889	22,120 47	113 03	22,233 50
1890	23,297 81	202 81	23,500 62
1891	24,638 33	267 53	24,905 86
1892	24,189 21	276 32	24,465 53
1893	23,696 16	463 97	24,160 13
1894	22,851 97	507 41	23,359 38
1895	22,939 51	291 34	23,230 85
1896	23,148 96	293 17	23,442 13
1897	22,028 08	335 11	22,363 19
1898	22,108 12	661 57	22,769 69
1899	22,959 72	530 17	23,489 89
1900	24,318 23	363 22	24,681 45
1901	23,995 38	655 96	24,651 34
1902	24,474 59	519 84	24,994 43
1903	24,993 28	742 91	25,736 19
1904	24,517 77	2,448 72	26,966 49
Totals	$600,496 37	$10,737 54	$611,233 91

BONDS AND INTEREST

Refunding bonds to the amount of $19,000 have been issued during the year—$9,000 dated Feb. 16th, 1904, payable Feb. 16th, 1934, and $10,000 dated June 1st, 1904, payable June 1st, 1934; these bonds bear interest at the rate of 4 per cent per annum. The proceeds from the sale of these bonds were used to retire $19,000 of the original bonds issued for the construction of water works, of which $9,000 were Series No. 18, issued August 15th, 1872, payable Feb. 16th, 1904, and $10,000 were Series No. 37, issued June 1st, 1875, payable June 1st, 1904.

The total amount of interest on water works bonds and water works refunding bonds falling due during the year was $18,430, which was paid by tax levy. The total amount of interest paid to date on water works bonds and water works refunding bonds is $860,745, all of which has been paid by tax levy.

The total amount of water works bonds which has been paid and retired (not refunded) to date is $110,000.

Water Works bonds now outstanding, $342,000; of which $100,000 are original water works construction bonds issued in 1873 and 1874, bearing interest at 8 per cent per annum. $75,000 are original bonds issued in 1891, bearing interest at 5 per cent per annum, and $167,000 are refunding bonds bearing interest at 4 per cent per annum.

Water Works Bonds and Water Works Refunding Bonds Outstanding December 31st, 1904

Series	Date of Issue	Date Payable	Amount	Interest
No. 19	Aug. 15, 1873	Feb. 16, 1905	$10,000 00	8 %
No. 20	" 15, 1873	Feb. 16, 1906	10,000 00	8 %
No. 21	" 15, 1873	Feb. 16, 1907	10,000 00	8 %
No. 22	" 15, 1873	Feb. 16, 1908	10,000 00	8 %
No 23	" 15, 1873	Feb 16, 1909	10,000 00	8 %
No. 24	Feb. 15, 1874	Feb. 16, 1910	10,000 00	8 %
No. 25	Apr. 15, 1874	April 15, 1911	10,000 00	8 %
No. 26	" 15, 1874	" 15, 1912	10,000 00	8 %
No. 27	" 15, 1874	" 15, 1913	20,000 00	8 %
Not Seried—				
Nos. 1 to 25	May 1, 1891	May 1, 1906	25,000 00	5 %
Nos. 26 to 50	May 1, 1891	" 1, 1911	25,000 00	5 %
Nos. 51 to 63	May 1, 1891	" 1, 1917	12,500 00	5 %
Nos. 64 to 76	May 1, 1891	" 1, 1918	12,500 00	5 %
Refunding Bonds—				
Nos. 1 to 20	Oct. 1, 1895	Oct. 1, 1920	20,000 00	4 %
Nos. 1 to 20	Oct. 1, 1896	" 1, 1921	20,000 00	4 %
Nos. 1 to 20	Oct. 15, 1897	" 15, 1927	20,000 00	4 %
Nos. 1 to 18	Oct. 15, 1898	" 15, 1928	18,000 00	4 %
Nos. 1 to 20	Mar. 1, 1900	Mar. 1, 1930	20,000 00	4 %
Nos. 1 to 20	Mar. 1, 1901	" 1, 1931	20,000 00	4 %
Nos. 1 to 10	June 1, 1902	June 1, 1932	10,000 00	4 %
Nos. 1 to 10	Feb. 1, 1903	Feb. 1, 1933	10,000 00	4 %
Nos. 1 to 10	June 1, 1903	June 1, 1933	10,000 00	4 %
Nos. 1 to 9	Feb. 16, 1904	Feb. 16, 1934	9,000 00	4 %
Nos. 1 to 10	June 1, 1904	June 1, 1934	10,000 00	4 %
Total			$342,000 00	

Average rate of Interest..... 5 11/19 %

SOURCE OF SUPPLY

The total quantity of water taken from the river was 10,850,000 gallons, or about 1 per cent of all of the water pumped. The total length of time, during the year, in which the river was drawn upon to help out the supply was 392 hours and 17 minutes on the dates as given below:

January 4, 2 hours, account sugar factories.
January 5, 10 minutes, fire.
January 7, 30 minutes, fire.

January 11, 1 hour, 15 minutes, fire.
January 12, 15 minutes, fire.
January 15, 12 minutes, fire.
January 17, 20 minutes, fire.
January 18, 10 minutes, fire.
January 24, 25 minutes, fire.
January 25, 22 minutes, fire.
January 25, 8 hours, account sugar factories.
January 26, 40 minutes, fire.
January 27, 10 hours, account sugar factories.
January 28, 10 hours, account sugar factories.
January 29, 8 hours, account sugar factories.
February 1, 3 hours, account sugar factories.
February 1, 58 minutes, fire.
February 2, 6 hours, account sugar factories.
February 3, 5 hours, account sugar factories.
February 4, 10 hours, account sugar factories.
February 5, 9 hours, account sugar factories.
February 8, 10 hours, account sugar factories.
February 9, 5 hours, account sugar factories.
February 10, 10 hours, 30 minutes, account sugar factories.
February 10, 1 hour, fire.
February 11, 11 hours, account sugar factories.
February 12, 11 hours, 30 minutes, account sugar factories.
February 15, 17 hours, account sugar factories.
February 16, 22 hours, account sugar factories.
February 16, 2 hours, fire.
February 17, 24 hours, account sugar factories.
February 18, 20 hours, 10 minutes, account sugar factories.
February 18, 3 hours 50 minutes, fire.
February 19 and 20, 48 hours, account sugar factories.
February 21, 5 hours, account sugar factories.
February 22, 6 hours, account sugar factories.
February 23, 7 hours, account sugar factories.
February 24, 6 hours, account sugar factories.
February 25, 24 hours, account sugar factories.
February 26, 23 hours, account sugar factories.
February 26, 1 hour, fire.
February 27, 18 hours, account sugar factories.
February 29, 1 hour, fire.
March 1, 6 hours, account sugar factories.
March 3, 5 hours, account sugar factories.
March 14, 20 minutes, fire.
March 18, 30 minutes, fire.
July 23rd, 40 minutes, fire.
September 3rd, 3 hours, repairs at bay.
November 2, 2 hours, 20 minutes, fire.
November 9, 30 minutes, fire.
November 29, 2 hours, 10 minutes, fire
November 29, 10 hours, account sugar factories.
November 30, 4 hours, account sugar factories.
December 6, 1 hour, fire.
December 29, 3 hours, 30 minutes, fire.

392 hours, 17 minutes.

Extra demand for fire service, 25 hours, 7 minutes.
Repairing works at bay, 3 hours.
Account sugar factories, 364 hours, 10 minutes.

392 hours, 17 minutes.

MAIN DISTRIBUTION

The main distribution system has been extended during the year as follows:

A six inch cast iron main has been laid in Fifth avenue from Johnson street to Trumbull street.

A six inch cast iron main has been laid in Stanton street from LaFayette avenue to Twenty-sixth street.

A six inch cast iron main has been laid in Columbus avenue from Saginaw street to alley between Saginaw street and Washington avenue.

Cast iron pipes have been substituted for Wyckoff mains as follows:

In Johnson street from Center avenue to Woodside avenue.

In Woodside avenue from Johnson street to Sherman street.

In Garfield avenue from Columbus avenue to La Fayette avenue.

In alley between Adams and Jefferson streets from Center avenue to Sixth street.

In alley between Washington avenue and Adams street from Center avenue to Sixth street.

Additional fire hydrants have been set in the following described locations:

On northeast corner of Fifth avenue and Pendleton street.

On northeast corner of Fifth and Chase street.

On east side of Johnson street, 289 feet south of Woodside avenue.

On northeast corner of Woodside and Seymour avenues.

On north side Sixth street, east of alley between Adams and Jefferson streets.

On northeast corner of Twenty-fourth and Stanton streets.

On northeast corner of Twenty-fifth and Stanton streets.

On northeast corner of Twenty-sixth and Stanton streets.

The fire hydrant before located on the south side of Woodside avenue opposite Belinda street, has been removed to the northwest corner of Woodside avenue and Belinda street.

The fire hydrant before located at the northwest corner of Woodside avenue and Shearer street has been removed to the northeast corner of the same street.

The fire hydrant before located at the southeast corner of Woodside avenue and Sherman street has been removed to the northeast corner of the same streets.

The fire hydrant before located at the southeast corner of Thirteenth and Fraser streets has been removed to the northwest corner of Thirteenth and Fitzhugh streets.

All other hydrants taken out were replaced in approximately the same location as before.

The length of pipe laid during the year was:

10-inch cast iron	2,622 feet
8-inch cast iron	3,628 feet
6-inch cast iron	4,648 feet
4-inch cast iron	192 2-3 feet
Total	11,090 2-3 feet

The length of pipe taken out or abandoned was:

10-inch cast iron	67½ feet
8-inch cast iron	12 feet
6-inch cast iron	50¼ feet
Total cast iron	129¾ feet
10-inch Wyckoff	6,167 2-3 feet
8-inch Wyckoff	156 feet
6-inch Wyckoff	2,931¼ feet
4-inch Wyckoff	161 1-6 feet
Total Wyckoff	9,416 1-12 feet
Total pipe taken out or abandoned	9,545 10-12 feet
Net increase in length of pipe in service	1,544 10-12 feet

The number of stop valves set in the distributing system during the year was 54:

12-inch Flower pattern	2
10-inch Flower pattern	4
8-inch Flower pattern	3
6-inch Flower pattern	13
4-inch Flower pattern	26
4-inch Galvin pattern	6
	54

The number of stop valves taken out was 37:

12-inch Galvin pattern	2
10-inch Flower pattern	4
6-inch Flower pattern	7
4-inch Flower pattern	18
4-inch Galvin pattern	6
	37
Net increase in number of valves in service	17

The number of fire hydrants set during the year was 34:

Holly pattern	13
Matthews pattern	21
	34

The number of fire hydrants taken out was 26:

Holly pattern	12
Matthews pattern	14
	26
Net increase in number of hydrants in service	8

Main Pipes in Service December 31st, 1904

Size	Cast Iron	Wyckoff.	Total
20 inch	9,563 ft.		9,563 ft.
16 inch	13,789 ft.		13,782 ft.
12 inch	9,089 ft. 6 in.		9,089 ft. 6 in.
10 inch	20,959 ft. 10 in.	15,309 ft. 9 in.	36,269 ft. 7 in.
8 inch	28,243 ft.	14,761 ft. 3 in.	43,004 ft. 3 in
6 inch	58,237 ft.	67,839 ft.	126,076 ft.
4 inch	4,555 ft. 7 in.	13,399 ft.	17,954 St. 7 in.
Totals	144,429 ft. 11 in.	111,309 ft.	255,738 ft. 11 in.

Total cast iron mains, 27 miles, 1870 feet.
Total Wyckoff mains, 21 miles, 429 feet.
Total mains, 48 miles, 2299 feet.

Percentage of each size:

20	inch	3.74 per cent
16	inch	5.39 per cent
12	inch	3.55 per cent
10	inch	14.18 per cent
8	inch	16.82 per cent
6	inch	49.30 per cent
4	inch	7.02 per cent

Valves in Service December 31st, 1904

Pattern	20 in.	16 in.	12 in.	10 in.	8 in.	6 in.	4 in.	3 in.	Total
Flower	4	9	5	39	58	226	365	1	708
Galvin						6	42		48
Eddy						5	11		16
Brown			1			1			2
Total	4	9	6	39	58	238	419	1	774

The above list includes 12 blow off valves, one 6-inch and eleven 4-inch.

Fire Hydrants in Service December 31st, 1904

Matthews, 6-inch inlet, 3 hose nozzles, gated	32
Matthews, 4-inch inlet, 2 hose nozzles	244
Bourbon, 6-inch inlet, 3 hose nozzles, gated	5
Bourbon, 4-inch inlet, 2 hose nozzles	10
Holly, 4-inch inlet, 2 hose nozzles	134
Gaskill, 4-inch inlet, 2 hose nozzles	16
Galvin, 4-inch inlet, 2 hose nozzles	2
M. B. & I. Works, 6-inch inlet, 3 hose nozzles, gated	6
M. B. & I. Works, 4-inch inlet, 2 hose nozzles	2
Total	451

The amount expended during the year on account of extensions and renewals of the main distribution system was $10,697.29, as follows:

Cast iron pipe, (253 1919-2000 tons)	$ 5,751 73
Valves and valve boxes	582 83
Fire hydrants	196 55
Laying pipe	4,166 18
	$10,697 29

WATER METERS

The number of water meters set during the year was 101; and the number taken out was 33; making increase in number of meters in service 68. Total number of meters in service December 31st, 1904, 1,083.

The number of new meters purchased during the year was 84, as follows:

30 ⅝ inch Hersey Disc (Model F.)
24 ⅝ inch Thomson Lambert.
12 ⅝ inch Trident.
18 ⅝ inch Keystone.

The amount expended during the year on account of the extensions of the meter system was $783.21 as follows:

For 84 new meters	$724 77
For setting meters	58 44
	$783 21

Meters Taken Out in 1904

	2 in.	1½ in.	1 in.	¾ in.	⅝ in.	½ in.	⅜ in.	Total
Union Rotary	1	1			2			4
Union Duplex					1			1
Columbia					1			1
Crown			2	4		1	3	10
Empire				5		3		8
Nash A					2			2
Worthington					3			3
Hersey Disc					2			2
Thomson Bee						1		1
Trident					1			1
Total	1	1	2	9	12	5	3	33

20 of the meters taken out were on services which have been abandoned either temporarily or permanently; 12 were replaced by other meters and one was on a service since supplied at fixed rate.

Meters Set in 1904

	4 in.	2 in.	1½ in.	1 in.	¾ in.	⅝ in.	½ in.	⅜ in.	Total
Union Rotary	1	1				2			4
Union Rotary A						1			1
Columbia						1			1
Crown			1	4				3	8
Empire				1	1				2
Nash A						1			1
Nash AAX						6			6
Worthington		1	1						2
Hersey Disc						2			2
Hersey Disc F						35			35
Thomson				1	1				2
Thomson Bee							3		3
Thomson Lambert						16			16
Trident						16			16
Keystone						12			12
Totals	1	2	2	6	2	89	3	3	101

12 of these meters were to replace those taken out at the time these were set; 3 were for the renewal of services which had been abandoned in previous years and 90 were placed on services not before under meter.

Meters in Service December 31st, 1904

	8 in.	6 in.	4 in.	3 in.	2 in.	1½ in.	1 in.	¾ in.	⅝ in.	½ in.	⅜ in.	Total
Union Rotary	1	1	4	14	6	3	3	1	41			74
Union Rotary A						1			52			53
Union Duplex									17			17
Columbia									28			28
Crown						1	22	30		37	40	130
Empire							4	27		17		48
Empire A									11			11
Empire AA									39			39
Nash									31			31
Nash A									40			40
Nash AAX									6			6
Worthington					7	5			11			13
Worthington Disc									5			5
Hersey							2	5	25			32
Hersey Disc									41			41
Hersey Disc F									64			64
Thomson							2	2	102			106
Thomson B									18	72		90
Thomson Lambert									62			62
Trident									153			153
Westinghouse									4			4
Pittsburg Disc									6			6
Keystone									30			30
Totals	1	1	4	14	13	10	33	65	786	116	40	1083

Meters on Hand Not in Service December 31st, 1904

	4 in.	3 in.	2 in.	1½ in.	1 in.	¾ in.	⅝ in.	½ in.	⅜ in.	Total
Union Rotary	2	6	.....	1	.....	.....	.....	.....	.....	9
Union Rotary A	.....	.....	.....	.....	.....	.....	1	.....	.....	1
Union Duplex	.....	.....	.....	.....	.....	.....	5	.....	.....	5
Columbia	.....	.....	.....	.....	.....	.....	1	.....	.....	1
Crown	.....	.....	.....	.....	3	4	.....	1	2	10
Empire	.....	.....	.....	.....	2	8	.....	8	.....	18
Gem	.....	.....	1	.....	.....	.....	.....	.....	.....	1
Nash A	.....	.....	.....	.....	.....	.....	1	.....	.....	1
Worthington	.....	.....	.....	1	.....	.....	5	.....	.....	6
Hersey	.....	.....	.....	.....	.....	.....	1	.....	.....	1
Hersey Disc F	.....	.....	.....	.....	.....	.....	6	.....	.....	6
Thomson Lambert	.....	.....	.....	.....	.....	.....	8	.....	.....	8
Westinghouse	.....	.....	.....	.....	.....	.....	2	.....	.....	2
Keystone	.....	.....	.....	.....	.....	.....	6	.....	.....	6
Total	2	6	1	2	5	12	36	9	2	75

The total cost of the meter system to date is $21,904.79:

1083 meters in service cost	$ 18,347 11	
75 meters in stock, cost	2,118 48	
Meter fittings in stock	139 38	
Labor, etc., on 160 meters taken out	1,266 47	
3 motor indicators (taken out)	33 35	
		$21,904 79

PUMPING STATION

The total quantity of water pumped during the year as indicated by the revolutions of the pumps with no allowance for slip, was 1,091,013,061 gallons, of which 1,074,645,081 gallons were pumped against a domestic pressure of 40 lbs. per square inch, and 16,367,980 gallons were pumped against a fire pressure of from 70 lbs. to 80 lbs. per square inch at the pressure gauge in the pumping station. The average head against which all of the water was pumped, including suction lift was 113 feet.

The Gaskill engines and pumps were run 8,713 hours and 5 minutes and pumped 1,062,225,734 gallons.

The Quadruplex engines and pumps were run 477 hours and 40 minutes and pumped 26,339,225 gallons.

The H. P. engine and rotary pumps were run 36 hours and pumped 2,448,102 gallons.

The amount expended during the year for operating the pumping engines was $8,868.65 as follows:

Engineer's and firemen's wages	$ 3,770 68	
Fuel	4,324 30	
Oil, packing and supplies	391 03	
Repairs on engines and boilers	374 12	
Repairs on boiler arches	8 52	
		$8,868 65

The quantity of fuel at the pumping station, January 1st, 1904, was:

78,800 lbs. R. of M. coal cost	$ 92 58	
87,500 lbs. slack cost	74 47	
4 cords wood cost	10 00	
		$ 177 05

Delivered at pumping station during the year:

462,400 lbs. R. of M. coal cost	$ 543 33	
4,430,700 lbs. slack cost	3,765 97	
6 cords wood cost	15 00	
		$ 4,324 30

Fuel on hand December 31st, 1904:

10,000 lbs. R. of M. coal cost	$ 11 75	
140,000 lbs. slack cost	119 00	
4½ cords wood cost	11 25	
		$ 142 00

Fuel consumed during the year:

4,909,400 lbs. coal cost	$ 4,345 60	
5½ cords wood cost	13 75	
		$ 4,359 35

Oil, packing and supplies:

On hand, January 1st, 1904	$ 121 33	
Delivered at pumping station during year	391 03	
		$ 512 36
On hand December 31st, 1904	$ 250 50	
Used during the year	261 86	
		$ 512 36

The net cost of operating the pumping engines was:

Engineer's and firemen's wages	$ 3,770 68	
Fuel consumed	4,359 35	
Oil, packing and supplies used	261 86	
Repairs on engines and boilers	374 12	
Repairs on boiler arches	8 52	
		$ 8,774 53
Average cost of coal per ton (2000 lbs) in bins	$ 1 77	

The cost of pumping, based on net cost of operating the pumping engines, $8,774.53, was:

Per million gallons pumped	$8 04
Per million gallons raised 100 feet	$7 12

The cost of fuel consumed, $4,359.35, was:

Per million gallons pumped	$4 00
Per million gallons raised 100 feet	$3 62

PUMPING PLANT

BOILERS.

One boiler (No. 1) (installed in 1872) horizontal tubular, 16 feet long, 66 inches in diameter, containing 105 tubes 16 feet long, 2¾ inches interior diameter. (This boiler is not used.)

One boiler (No. 2) (installed in 1899) horizontal tubular, 16 feet long, 66 inches in diameter, containing 64 tubes 16 feet long and 3¾ inches interior diameter.

One boiler (No. 3) (installed in 1898) horizontal tubular, 16 feet long, 66 inches in diameter, containing 64 tubes 16 feet long and 3¾ inches interior diameter.

Two boilers (Nos. 4 and 5) (installed in 1893) horizontal tubular, 16 feet long, 60 inches in diameter, each containing 48 tubes 16 feet long and 3¾ inches interior diameter.

The area of grate surface under each boiler is:

No. 1, 27½ square feet.

Nos. 2 and 3, each 24¾ square feet.

Nos. 4 and 5, each 22½ square feet.

Heating surface in each boiler:

No. 1, (½ shell 138 24-100 sq. feet, entire tubes 1209 51-100 sq. feet) 1347 75-100 square feet.

Nos. 2 and 3, each (½ shell 138 24-100 sq. feet, entire tubes 1005 31-100 sq. feet) 1143 55-100 square feet.

Nos. 4 and 5, each (½ shell 125 66-100 sq. feet, entire tubes 753 98-100 sq. feet) 879 64-100 square feet.

ENGINES AND PUMPS.

One "Gaskill" horizontal compound condensing crank and fly wheel pumping engine (installed in 1886) maximum capacity 5 million gallons in 24 hours.

One Holly "Quadruplex," compound condensing crank and fly wheel pumping engine, (installed in 1872) maximum capacity 3 million gallons in 24 hours.

One horizontal high pressure piston engine, (installed in 1879) driving through gears, two No. 10 Holly rotary pumps, (installed in 1872) maximum capacity 2½ million gallons in 24 hours.

Capacity of Gaskill pumps per revolution, 118 gallons.

Capacity of Quadruplex pumps (4) per revolution, 55 gallons.

Capacity of Rotary pumps (2) per revolution, 17 gallons.

Quantity of water pumped each year since the works commenced supplying water.

1873.....	142,477,725	gallons	1889.....	944,472,747	gallons
1874.....	294,714,798	"	1890.....	988,771,453	"
1875.....	416,756,579	"	1891.....	1,014,475,024	"
1876.....	518,197,129	"	1892.....	962,953,662	"
1877.....	538,847,186	"	1893.....	1,044,256,236	"
1878.....	530,197,397	"	1894.....	1,024,735,621	"
1879.....	672,344,128	"	1895.....	1,122,363,460	"
1880.....	827,067,372	"	1896.....	1,009,523,471	"
1881.....	944,382,043	"	1897.....	944,545,290	"
1882.....	*775,642,466	"	1898.....	1,038,794,253	"
1883.....	773,942,702	"	1899.....	1,118,599,631	"
1884.....	831,867,463	"	1900.....	1,142,339,229	"
1885.....	836,970,016	"	1901.....	1,082,691,511	"
1886.....	779,761,852	"	1902.....	1,069,661,847	"
1887.....	827,195,000	"	1903.....	1,104,212,781	"
1888.....	872,990,164	"	1904.....	1,091,013,061	"

*commenced setting meters late in 1881.

WATER PUMPED, 1904

Month	Gaskill Engines			Quadruplex Engines			H. P. Engines and Rotary Pumps			Totals		Fires					
	Hours Run	Revolutions	Gallons Pumped	Hours Run	Revolutions	Gallons Pumped	Hours Run	Revolutions	Gallons Pumped	Gallons Pumped	Daily Average	No. Alarms.	Hours Run	Highest Pressure	Lowest Pressure	Average Pressure	Gallons Pumped
January...	742.30	855,645	100,966,110	2.45	5,637	310,035	1.30	5,759	97,903	101,374,048	3,270,131	18	7.26	80	70	73	1,527,189
February..	693.30	876,875	103,471,250	2.45	4,140	227,700	2 30	9,300	158,100	103,857,050	3,581,277	14	10.42	80	70	71	2,185,099
March	742.00	823,276	97,146,568	2.00	2,938	161,590	2.00	8,556	145,452	97,456,610	3.143,665	11	3.44	70	70	70	654,428
April.....	701.10	*692,151	*80,976,851	28.40	56,450	3,104,750	.....	.....	....	84,081,601	2,802,720	10	3.04	70	70	70	473,913
May	738.15	700,811	82,695,698	5.45	14,355	789,595	. ..	.....	.....	83,485,293	2,693,072	19	9.49	70	70	70	1,464,970
June	718.10	726,442	85,720,156	1.50	3,526	193,930	1 50	8,072	137,221	86,051,310	2,868,377	20	5.56	80	70	71	1,045,008
July.....	742.05	758,350	89,485,300	3.30	8,268	454,740	....	.....	.....	89,940,040	2,901,292	17	7.06	70	70	70	1,223,156
August....	741.00	755,350	89,131,300	3.00	7,386	406,230	.....	.....	.....	89,537,530	2,888.308	21	7.50	70	70	70	1,304,699
September	702.55	*961,950	80,196,691	320.05	265.977	14,618,835	12.40	52,302	889,134	95,703,660	3,190,122	9	2.32	70	70	70	524,083
October ..	744.00	703,764	83,044,152	....	.....	....	.....	.. ....	.....	83,044,152	2,678,844	14	6.06	70	70	70	941,286
November	720.00	690,287	81,453,866	1.20	2,243	123,365	.....	.....	.....	81,577,231	2.719,241	24	14.47	80	70	72	2,568,679
December .	728.30	*811,437	*87,938,792	106.00	108,155	5,948,525	15.30	60 017	1,090,289	94,907,606	3,061,536	17	11.32	80	70	73½	2,455,561
Totals.. ..	8,713.05	*9,386,338	*1,062,225,734	477.40	449,075	26,339,225	36 00	144,006	2,448,102	1,091,012,061	2,980,910	194	90.22	80	70	71¼	16,367,980

*In April the Gaskill Engines were run 9 hours with the right pump disconnected, making 10,355 Revolutions, and 50 minutes with the left pump disconnected, making 1,458 revolutions.

*In September the right Gaskill engine and pump were run 304 hours and 30 minutes with left engine and pump disconnected making 504,651 revolutions.

*In December the left Gaskill engine and pump were run 86 hours and 30 minutes with right engine and pump disconnected, making 132,386 revolutions.

A total of 648,850 revolutions of Gaskill engines at ½ capacity.

Daily average for year, 2,980,910 gallons.

Least quantity pumped in one day (May 22nd), 2,422,540 gallons.

Greatest quantity pumped in one day (February 18th), 4,124,100 gallons.

GENERAL MAINTENANCE AND REPAIRS

The total amount expended during the year for operating expenses and repairs, exclusive of the cost of operating the pumping engines was $6,685.68, as follows:

Office salaries	$ 2,600	00
Office expenses	284	44
Repairs on main distribution	1,320	67
Repairs and care of services	632	16
Repairs and care of water meters	1,000	59
Service connections	169	87
Repairs and care of inlet works at bay	518	21
Repairs to river inlet	68	80
Repairs to engine house	49	90
Repairs and care of engine house grounds	41	04
	$ 6,685	68

The number of leaks in the main distribution system during the year was 92, of which 87 were in the Wyckoff main and 5 in the cast iron mains. All of the leaks in cast iron mains were in lead joints and were repaired by recaulking the lead. 27 leaks in Wyckoff mains were burst pipe, 55 were joint leaks and 5 were knot holes.

Two 12-inch valves placed in Trumbull street and in Second street mains in 1886, have never worked satisfactorily; they have been replaced by "Flower" valves.

The extremely cold weather in January, February and March called for extraordinary vigilance in the care of the fire hydrants and testing for frozen hydrants. 164 hydrants were found frozen and were thawed out by employes of this department. There was no additional fire loss during severe weather which could be charged to frozen hydrants.

The details of expenditures for repairs on main distribution were as follows:

Labor repairing leaks in Wyckoff mains	$ 394	00
Pipe for repairing leaks in Wyckoff mains	184	82
Labor repairing leaks in cast iron mains	52	36
Bolt and clamps for 20-inch main	13	78
Labor testing for and thawing frozen hydrants	133	90
Labor repairing, draining and flushing hydrants	192	78
Shop repairs on hydrants	78	53
Repairing valves and valve boxes	18	98
Changing two 12-inch valves	124	13
Moving and changing pipes and hydrants	108	61
Tools and repairing tools	18	78
	$ 1,320	67

The number of services shut off by employees of this department during the year was 364; of which 36 were shut off for nonpayment of rates, 15 for leaks, 147 premises vacant, 58 hose for sprinkling season only, 101 at request of consumer and 7 services abandoned.

The number of sewers opened was 391.

17 service and private mains were repaired by the department, of which 10 were private Wyckoff mains each supplying several consumers. One wrought iron private main, 2 cast iron services and 4 lead services.

The expenditures for repairs and care of services were:

Labor turning on and off water	$ 293 75	
Examining services and notifying consumers	164 25	
Repairing and changing service connections	45 08	
Repairing private mains and services	129 08	
		$ 632 16

The number of water meters broken by frost during the extreme weather of the early part of the year was 25; this is a very small percentage as compared with the damage in other cities of this latitude. The rubber pistons in 5 meters have been ruined by hot water.

The whole number of meters repaired by the inspector was 189, and 136 have been cleaned and started which required no repairs. The number of meters tested in the shop was 256.

The expenditures for repairs and care of water meters were:

Reading and inspection	$,390 00	
Repairing meters in shop	375 00	
Parts from manufacturers for repairs	57 24	
Repairs on meters sent to manufacturers	39 93	
Repairs on meter connections	7 22	
Protecting and draining meters	36 39	
Repairs to meter boxes	67 46	
Building cement and brick boxes	18 00	
Tools and repairing tools	9 35	
		$1,000 59

The amount expended during the year on account of service connections was $169.87, as follows:

12	1-inch corporation cocks	$ 20 01	
48	¾-inch corporation cocks	49 82	
36	⅝-inch corporation cocks	29 46	
36	½-inch corporation cocks	21 01	
	Labor tapping mains	45 50	
	Rethreading old taps	83	
	Tools and repairing tools	3 24	
			$ 169 87

SERVICE CONNECTIONS AND SERVICES

The number of new service connections made with the main pipes was 188 and the number taken out was 104. Net increase in number of service connections, 84:

The service connections put in were:

	1 in.	¾ in.	⅝ in.	½ in.	⅜ in.	Total
In Cast Iron Mains	7	10	66	66	.....	149
In Wyckoff Mains	2	3	14	19	1	39
Total	9	13	80	85	1	188

The service connections taken out were all in Wyckoff mains and were of the following sizes:

8 1 inch.
24 ¾ inch.
28 ⅝ inch.
42 ½ inch.
2 ⅜ inch.

Total number of service connections in main pipes December 31st, 1904, 2,353.

	Branches					Corporation Cocks							Total
	8 in.	6 in.	4 in.	3 in.	2 in.	2 in.	1¼ in	1 in	¾ in.	⅝ in.	½ in.	⅜ in.	
In Cast Iron Mains.	2	6	17	3	4	2	3	93	161	476	463	5	1235
In Wyckoff Mains..	.	1	9	1	1	..	....	83	206	349	463	5	1118
Totals.	2	7	26	4	5	2	3	176	367	825	926	10	2353

Of the above service connections 102 have been abandoned and services from the same temporarily discontinued as follows:

	Branches			Corporation Cocks						Total
	6 in.	4 in.	3 in.	1¼ in	1 in.	¾ in.	⅝ in.	½ in.	⅜ in.	
In Cast Iron Mains.....	1	1	1	1	8	15	8	17	4	56
In Wyckoff Mains.....	.....	2	.....	.....	8	12	9	13	2	46
Totals.....	1	3	1	1	16	27	17	30	6	102

Number of service connections with services connected, 2,251:

Number of separate services supplied	2,487
Number of services open December 31st, 1904	1,932
Number of services shut off December 31st, 1904	555

The entire cost of maintaining and operating the plant including the interest on the bonded debt, which has been paid by tax, was $33,984.33.

The department is entitled to credits as follows:

Water rates collected	$ 26,004 39	
Miscellaneous—collections (not on construction).	356 75	
		$26,361 14

Public uses from which no revenue is received:

451 public fire hydrants @ $45 each	$ 20,295 00	
17 public watering troughs @ $150 each	2,550 00	
8 public drinking fountains @ $25 each	200 00	
4 ornamental fountains @ $50 each	200 00	
City hall	200 00	
City electric light plant	361 00	
6 fire department stations @ $25 each	150 00	
Street sprinkling	500 00	
Sprinkling public parks	150 00	
Flushing sewers	2,000 00	
		$26,606 00

Uses furnished free under orders of city council:

One Bethel Mission	$ 18 00	
One Old Ladies' Home	17 00	
One Children's Home	106 00	
		$ 141 00
Total credits		$53,108 14

All of which is respectfully submitted.

E. L. DUNBAR,
Superintendent and Secretary.

Summary of Statistics for the Year Ending December 31st, 1904

(In Form Recommended by the New England Water Works Association.)

BAY CITY WATER WORKS

Bay City, Bay County, Mich.

GENERAL STATISTICS

Population by census of 1900, 27,628.
Date of construction, 1872.
By whom owned, Bay City.
Source of supply, Saginaw Bay.
Mode of supply, direct pumping.

Pumping Statistics

1. Builders of pumping machinery, Holly Manf'g Co.
2. **Description of fuel**
   a. Kind, coal.
   b. Brand, bituminous slack, from local mines.
   c. Average price per gross ton, delivered, $1.98.
   d. Percentage of Ash, 23 per cent.
   e. Wood, price per cord, $2.50
3. Coal consumed for year, 4,909,400 pounds.
4. Pounds of wood consumed, divided by 3—equivalent amount of coal, 3,600 pounds.
5. Total equivalent coal consumed for year, 4,913,000 pounds.
6. Total pumpage for year, 1,091,013,061 gallons, (no allowance for slip).
8. Average dynamic head against which pump works. 113 feet.
9. Number of gallons pumped per pound of equivalent coal, 222.
10. Duty $= \frac{1,091,013,061 \times 8.34 \times 100 \times 113}{4,913,000} =$ 20,928,000.

Cost of pumping figured on pumping station expenses, $8,774.53.

11. Per million gallons pumped $8.04.
12. Per million gallons raised one foot, $0.0712.

Financial Statistics

RECEIPTS

Balance brought forward—		
a—From ordinary receipts		$10,803 01
From water rates—		
A—Fixed rates	$ 9,378 75	
B—Meter rates	16,625 64	
C—Total from consumers		26,004 39
K—From tax levy		18,430 00
L—From bond issue		19,000 00
M—From other sources—		
Miscellaneous, maintenance		356 75
Miscellaneous construction		782 04
		$75,376 19

EXPENDITURES

Water Works Maintenance—		
AA—Operation (management and repairs)	$15,554 33	
CC—Total maintenance		$15,554 33
DD—Interest on bonds		18,430 00
CC & DD—		33,984 33
EE—Payment of bonds		19,000 00
Water Works Construction—		
GG—Extension of meters	$ 783 21	
II—Extension of mains	10,697 29	
KK—Total construction		11,480 50
MM—Balance		10,911 36
		$75,376 19
Disposition of balance—Deposited with City Treasurer.		
O—Net cost of works to date		$641,606 36
P—Bonded debt		342,000 00
R—Average rate of interest, 5.4 per cent.		

Statistics of Consumption

1. Estimated population at date, 29,000.
2. Estimated population on pipe lines, 22,000.
3. Estimated population supplied, 18,500.
4. Total consumption for year, 1,091,013,061 gallons.
5. Passed through meters, 234,997,513 gallons.
6. Percentage of consumption metered, 21½ per cent.
7. Average daily consumption, 2,980,910 gallons.
8. Gallons per day to each inhabitant, 100.
9. Gallons per day to each consumer, 161.
10. Gallons per day to each service, 1,200.

11. Cost of supplying water per million gallons, figured on total maintenance ($15,554.33.) $14.26.
12. Total cost of supplying water per million gallons, figured on total maintenance and interest on bonds, ($33,984.33), $31.15.

Statistics Relating to Distribution System—Mains

1. Kind of pipe, cast iron and Wyckoff patent.
2. Sizes, 4 inch to 20 inch.
3. Extended, 11,090 2-3 feet.
4. Discontinued, 9,545 5-6 feet.
5. Total now in use, 48 miles, 2,299 feet.
6. Cost of repairs per mile, $27.27.
7. Number of leaks per mile, 1 9-10.
9. Number of hydrants added during year, public, 8.
10. Number of hydrants now in use, public, 451.
11. Number of stop gates added during year, 17.
12. Number of stop gates now in use, 774.
14. Number of blow offs, 12.
15. Range of pressure in mains, 35 lbs. to 80 lbs.

Services

16. Kind of pipe, lead, wrought iron and cast iron.
17. Sizes, 3-8 inch to 8 inch.
21. Number of services added during the year, 79.
22. Number now in use, 2,487.
25. Number of meters added, 68.
26. Number now in use, 1,083.
27. Percentage of services metered, 43 6-10 per cent.
28. Percentage of receipts from metered water, 64 per cent.

Expenditures for operating expenses and maintenance from the time the works commenced supplying water.

1873-4-5	$25 031 53	1890	$11,321 49
1876	9.039 26	1891	12.062 31
1877	9,326 74	1892	11.302 86
1878	8.417 42	1893	12.610 06
1879	8.357 94	1894	*16,977 98
1880	10.473 69	1895	*22.067 64
1881	11,030 37	1896	*18.731 58
1882	10.510 72	1897	*16,015 25
1883	11,726 39	1898	12.733 70
1884	14,560 90	1899	*15,.86 97
1885	13.079 90	1900	14,739 19
1886	14,528 61	1901	13,699 72
1887	11.739 29	1902	13,924 65
1888	10.969 25	1903	16,223 09
1889	10,500 11	1904	15,554 33

*In 1894 this includes $4,059 76 on improvements to intake works at Bay.
*In 1895 " " 9,264 18 " " " " "
*In 1896 " " 4,337 60 " " " " "
and 1,580 47 " " " " at River.
*In 1897 " " 3,825 52 " " " " at Bay.
*In 1899 " " 1,931 91 " " " " "

Wyckoff pipe in service, Dec. 31st, 1904, and the year in which it was laid.

1872—Twenty-fourth street from alley between Webster and McCormick streets, to alley between McCormick and Wilson streets ..... 267 feet
" —Alley between McCormick and Wilson streets from LaFayette avenue to Twenty-fourth street .....318½ feet
1873—Eighteenth street from west of Broadway to alley between Williams street and Garfield avenue ..... 758 feet
" —Alley between Williams street and Garfield avenue from Thirteenth street to Eighteenth street .....1675½ feet
1874—Woodside avenue from alley between Jefferson street and Madison avenue to alley between Madison avenue and Monroe street ..... 283 feet
" —Alley between Madison avenue and Monroe street from Woodside avenue to First street ..... 400 feet
" —Woodside avenue from Sherman to Grant street ..... 537¼ feet
" —Grant street from Woodside avenue to between Third and Fourth streets .....1,467¾ feet
" —Grant street from Center avenue to Tenth street ....1,768½ feet
" —Alley between Saginaw street and Washington avenue from Center avenue to Ninth street .....1,446 feet
" —Alley between Washington avenue and Adams street from Seventh street to Tenth street and crossing Sixth street .....1,126 feet
" —Alley between Adams and Jefferson streets, from Sixth street to Tenth street .....1,444½ feet

1874 —Alley between Madison avenue and Monroe street, from Center avenue to Tenth street .....1,755½ feet
" —Alley between Monroe and Jackson streets, from Center avenue to Tenth street .....1,766¼ feet
" —Alley between Jackson and Van Buren streets, from Center avenue to Tenth street ....1,731¾ feet
" —Alley between Washington avenue and Adams street, from Tenth street to Columbus avenue .....1,315½ feet
" —Fitzhugh street from Columbus avenue to Thirteenth street ..... 277 feet
1875—Tenth street from between Grant and Farragut streets to Sherman street ..... 420 feet
" —Sherman street from Tenth to Thirteenth street .....1,358½ feet
" —Thirteenth street from Fitzhugh to Sherman street ...2,508½ feet
" —Alley between Howard and Williams streets, from Eighteenth to Twenty-second streets .....1,292¼ feet
" —Stanton street from Twenty-second street to LaFayette avenue ..... 331 feet
" —Wilson street from LaFayette avenue to Fremont avenue .....2,470½ feet
" —Fremont avenue from Water street to Broadway ....1,812½ feet
" —Broadway from Fremont avenue to Cass avenue .....2,528¾ feet
1879—Henry street from Madison avenue to Water street ....365½ feet
" —Woodside avenue from alley between Jefferson street and Madison avenue to alley between Adams and Jefferson streets .....270½ feet
" —Trumbull street from Center avenue to North street ..1,498½ feet
1882—Farragut street from Center avenue to Tenth street ..1,722 feet
" —Alley between Jefferson street and Madison avenue, from Tenth to Eleventh street ..... 826 feet
" —Eleventh street from alley between Jefferson street Madison avenue to Madison avenue .....176½ feet
" —Madison avenue from Eleventh to Thirteenth street .. 674 feet
1883—Belinda street from Water street to Woodside avenue 1,649¼ feet
" —Fitzhugh street from Thirteenth to Fifteenth street .. 729 feet
" —Sherman street from Thirteenth to Nineteenth street.2,087 feet
" —Cass avenue from P. M. R. R. to Michigan avenue ....1,255¼ feet
1884—LaFayette avenue from Garfield avenue to Fitzhugh street ..... 527 feet
" —Fitzhugh street from LaFayette avenue to Twenty-second street ..... 388 feet
" —Broadway from LaFayette avenue to Fremont avenue 2,477¾ feet

1886—Sixth street from alley between Washington avenue and Adams street to Adams street ..... 118 feet
" —Adams street from Sixth to Seventh street ..... 330 feet
" —Seventh street from Adams street to alley between Washington avenue and Adams street ..... 125 feet
" —Water street from Sixth street to Ninth street .....998½ feet
" —Fitzhugh street from Fifteenth to Twenty-second street .....2,263¾ feet
" —Trumbull street from Second street to Center avenue .....1,409½ feet
" —Second street from alley between Jackson and Van Buren street to Johnson street .....2,610 feet
1887—Alley between Adams and Jefferson streets, from Tenth street to Columbus avenue .....1,288 feet
" —James street from Columbus avenue to Thirteenth street ..... 264 feet
" —Sherman street from Nineteenth to Twenty-second street .....1,012 feet
" —Twenty-second street from Sherman to Grant street .. 574¼ feet
1888—Lincoln avenue from Second street to Center avenue ..1,306 feet
" —Lincoln avenue from Sixth to Tenth street .....1,428 feet
" —Tenth street from Lincoln avenue to Sherman street . 553 feet
" —Johnson street from Sixth street to Ninth street ....1,068 feet
" —Ninth street from Johnson to Trumbull street .....1,138½ feet
" —Twenty-second street from Grant street to Michigan avenue .....1,386¼ feet
" —Michigan avenue from Twenty-second street to LaFayette avenue ..... 220 feet
" —LaFayette avenue from Michigan avenue to Fitzhugh street ..... 580 feet
" —Webster street from Fremont avenue to Cass avenue 2,523¾ feet
" —McEwan street from Water street to Campbell street 349½ feet
1889—McEwan street from Campbell street to Woodside avenue ..... 776½ feet
" —Woodside avenue from McEwan street to Park avenue ..... 205 feet
" —Park avenue from Woodside avenue to Fourth avenue.2,894 feet
" —Fourth avenue from Park avenue to Green avenue ...1,027½ feet
" —Green avenue from Fourth avenue to Center avenue.. 661 feet
" —Ingraham street from Cass avenue to Fortieth street.1,844 feet
" —Fortieth street from Harison to Ingraham street .... 678 feet
" —Alley between Saginaw street and Washington avenue, from Columbus avenue north ..... 239¼ feet

1890—Fortieth street from Harrison street to River street .. 271¼ feet
" —River street from Thirty-seventh street to Fortieth street .....1,200 feet
" —Polk street from Fremont avenue to Cass avenue ....2,542 feet
" —Michigan avenue from Fremont avenue to Cass avenue .....2,661 feet
" —Michigan avenue from LaFayette avenue to Twenty-fifth street ..... 699½ feet
" —Jennison avenue from Fremont avenue to Cass avenue .2,546 feet
" —Fremont avenue from Jennison avenue to Garfield avenue ..... 139 feet
" —Garfield avenue from LaFayette avenue to Fremont avenue .....2,479½ feet
" —Saginaw street from Tenth street to Columbus avenue .....1,337¼ fee
" —LaFayette avenue from Water street to Garfield avenue .....1,853¾ feet
1890—Van buren street from Second street to Center avenue.1,341 feet
' —Van Buren street from south of Columbus avenue to Thirteenth street ..... 172½ feet
' —Fourth avenue from Green avenue to Livington avenue 812½ feet
" —McLellan street from Center avenue to McKinley avenue .....1,079 feet
1891—Sherman street from Woodside avenue to Tenth street .....3,869 feet
" —Park avenue from Center avenue to Ridge Road ....2,096¾ feet
" —Lincoln avenue from Tenth street to Columbus avenue 1,060½ feet
" —Van Buren street from Thirteenth to Twenty-Second street .....3,120 feet
1892—Columbus avenue from Van Buren street to Sherman street ..... 853 feet
1893—Columbus avenue from Sherman street to Tuscola Road .....3,809½ feet
" —Ridge Road from Tuscola Road to Park avenue ..... 838 feet
" —Woodside avenue from alley between Madison avenue and Monroe street to Monroe street ..... 145 feet
" —Livingstone avenue from Fourth avenue south ..... 636½ feet
—Thirteenth street from Water street to alley between Williams street and Garfield avenue ..... 169 feet

111,309 feet